TM 11-4033

WAR DEPARTMENT TECHNICAL MANUAL

SIGNAL CORPS

RADIO RECEIVERS BC-603-A, -C, -D, -AM, -CM, AND -DM

REPAIR INSTRUCTIONS

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Refer to FM 21–6 for explanation of distribution formula.

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WARNING

HIGH VOLTAGE

is used in the operation

of this equipment.

DEATH ON CONTACT

may result if safety precautions

are not observed.

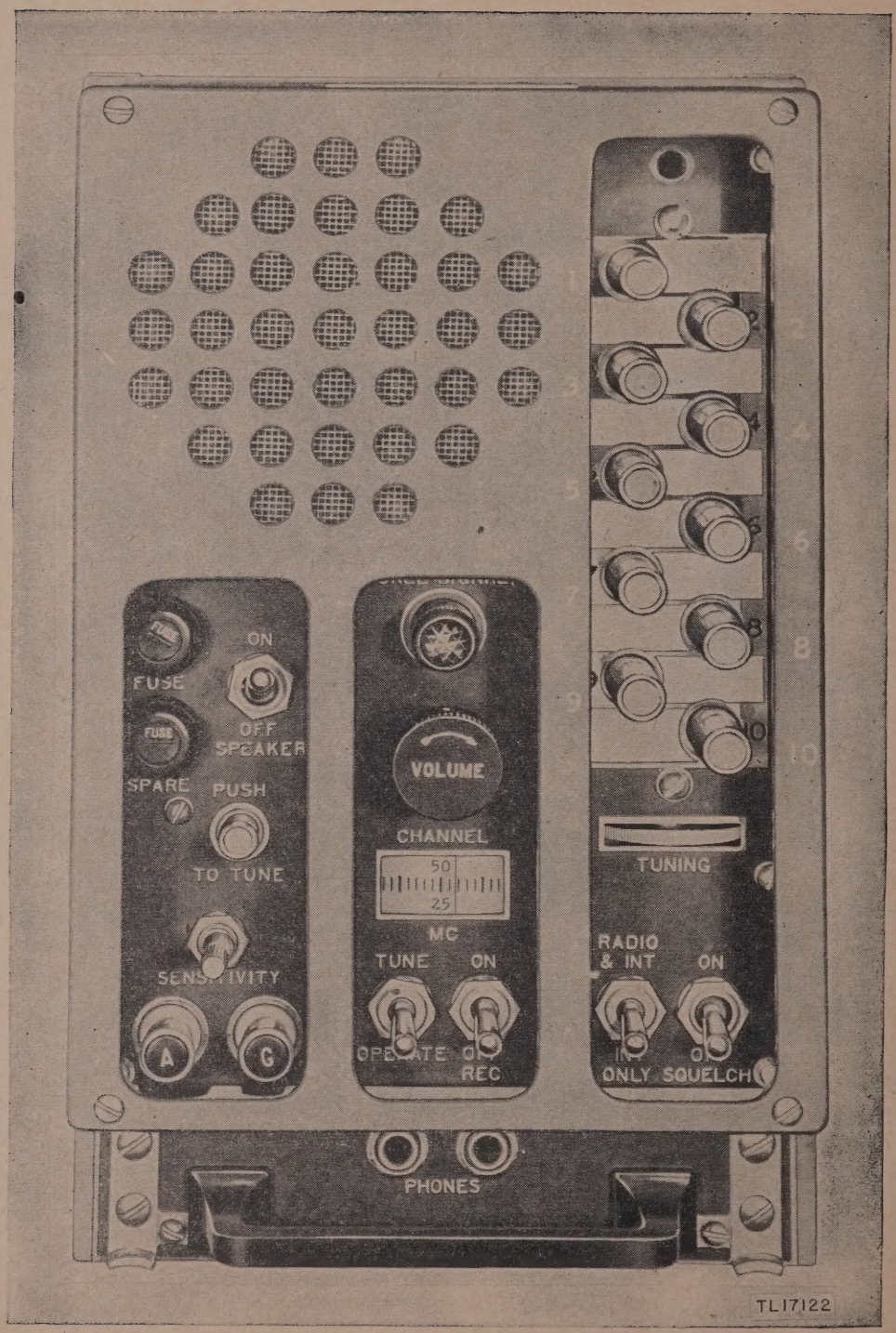


Figure 1. Radio Receiver BC–603–(*)—front view.

SECTION I

DESCRIPTION OF RADIO RECEIVERS BC–603–A, –C, –D, –AM, –CM, AND –DM*

1. General

Radio Receiver BC–603–(*) (figs. 1 and 2) is a component of Radio Sets SCR–508–(*), SCR–528–(*), SCR–538–(*), AN/VRC–5 and AN/TRR–3. The receiver provides frequency-modulated radiotelephone reception facilities for car, platoon, company battalion, and regimental commanders, and for staff officers and commanders in higher echelon. The receiver may be installed and operated in combat vehicles such as tanks, scout cars, half-tracks and command cars, or any other authorized vehicle. Official nomenclature followed by (*) is used to indicate all models of the item of equipment included in this Technical Manual. Thus Radio Receiver BC–603–(*) represents BC–603–A, –C, –D, –AM, –CM, and –DM.

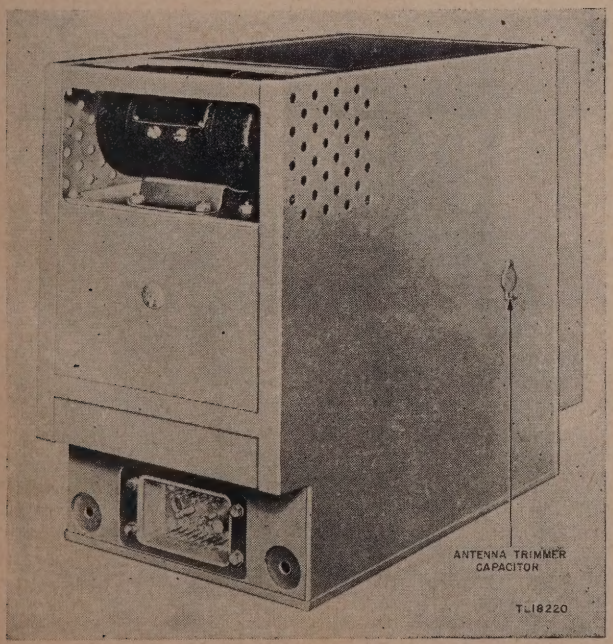


Figure 2. Radio Receiver BC–603–(*)—oblique rear view.

2. Performance Characteristics

Frequency range	20.0 to 27.9 mc.
Number of preset channels	10
Power supply	12– or 24–volt vehicular battery.
Control of channels	local only.
Sensitivity	1 μv.
Intermediate frequency (nominal)	2.65 mc.
Band width	80 kc.
Power output, speaker	2 watts.
Power output, headset	0.2 watt.
Call signal	lamp.
Noise suppression	squelch.
Battery drain, 12–volt supply	4 amperes.
Battery drain, 24–volt supply	2 amperes.

3. Condensed Circuit Analysis

A block diagram of Radio Receiver BC–603–(*) is shown in figure 3. The receiver uses the superheterodyne principle of operation. The high-frequency circuits include one stage of tuned radio-frequency amplification (V1), and modulator (V2), and a radio-frequency oscillator (V3). The intermediate-frequency amplifier comprises two stages (V4 and V5), the second of which (V5) provides some limiting action on strong signals. The limiter stage (V6) not only functions as a limiter on moderate signals, but it also reduces amplitude modulation. The detector, or discriminator (V7) is followed by two

*See TM 11–600 for installation, operation, and other maintenance data on this equipment.

stages of audio-frequency amplification (V10′ and V8). An intermediate-frequency oscillator (V10″) permits checking the receiver tuning. A single dual-purpose vacuum tube (V10) functions as the first audio stage (V10′) and the intermediate-frequency oscillator (V10″). A second dual-purpose tube (V9) provides delayed automatic volume control (V9′) and squelch (V9″), which suppresses noise by disabling the receiver output when no signal is being received. A tube chart follows.

Circuit designation	JAN designation	VT No.	Function
V1	6AC7	VT–112 ...	R-f amplifier.
V2	6AC7	VT–112 ...	Modulator.
V3	6J5	VT–94	R-f oscillator.
V4	12SG7	VT–209 ...	I-f amplifier.
V5	12SG7	VT–209 ...	I-f amplifier.
V6	6AC7	VT–112 ...	Limiter.
V7	6H6	VT–90	Detector (discriminator).
V8	6V6GT ...	VT–107–A	Second a-f amplifier.
V9	6SL7GT ..	VT–229 ...	Avc and squelch.
V10	6SL7GT ..	VT–229 ...	First a-f amplifier and i-f oscillator.

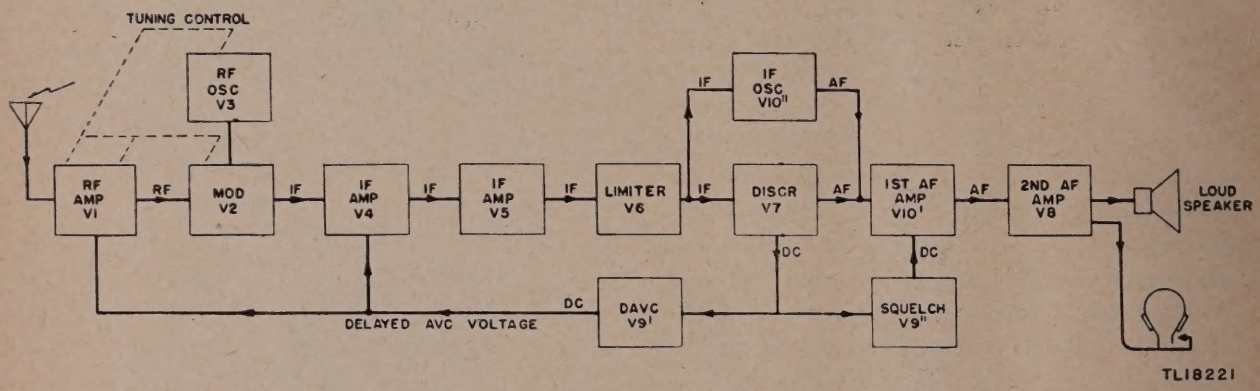


Figure 3. Radio Receiver BC–603–(*)—block diagram.

SECTION II

DIFFERENCES BETWEEN MODELS

4. Operational Differences

There are no operational differences between the various models of Radio Receiver BC–603–(*).

5. Design Differences

a. In some models of Radio Receiver BC–603–(*), resistors R94, R95, and R96, have been changed in order to increase the sensitivity of the receiver at the minimum setting of the SENSITIVITY control and to insure that the SQUELCH control is operative over the entire sensitivity range. See diagram of squelch circuit, figure 35.

b. Some models of Radio Receiver BC–603–(*) have a pivoted latch to hold down the PUSH TO TUNE button when needed.

Caution: The latch ***must*** be disengaged and left free when the push-button selector is used; otherwise, the added friction may prevent accurate resetting of the tuning capacitor, and an abnormal strain will be put on the mechanism when the selector push button is pressed.

c. In Radio Receiver BC–603–DM the TUNE-OPERATE switch is a two-circuit switch. This switch when set to TUNE causes the receiver beat oscillator to operate and open the circuits from transmitter relay S103 to prevent disabling of the receiver during tuning adjustment.

d. The TUNE-OPERATE switch D5 mounted on the front panels of Radio Receivers BC–603–A, –C, and –D has been changed. It is (in modified receivers only) a two-circuit type switch (Cutler-Hammer No. 8284) or equal. After this modification is made on Radio Receivers BC–603–A, –C, and –D, they become Radio Receivers BC–603–AM, –CM, and –DM.

SECTION III

INITIAL REPAIR PROCEDURES

6. General

Note. Before making any repairs or adjustments, all authorized Modification Work Orders should be applied. See FM 21–6 for list of applicable Modification Work Orders.

A step-by-step procedure is presented in this and the following sections for the repair and maintenance of Radio Receiver BC–603–(*). The succeeding sections go into detail on shop procedures for alignment, trouble shooting, signal tracing, etc., and also provide all the necessary charts, diagrams, and information. The initial repair procedure describes the method of removal of tubes and other easily removable parts; the cleaning, inspection, and testing of the chassis assembly; the cleaning, inspecting, testing, and lubrication of removed parts; and the repair or replacement of parts found to be faulty. The tool, test, and cleaning equipment required for the repair of Radio Receiver BC–603–(*) are shown in table I.

Table I. Tool, test, and cleaning equipment

Item	Description
Adapter FT–384–( ).	Switch box for connecting various parts of receiver circuit to facilitate alignment procedure. (See figs. 20, 21, and 22.)
Output meter.	Input impedance of 5,000 ohms or more, 0-to 60-volt range, as well as several lower ranges; such as the output meter (fig. 21) from Test Set I–56–(*), or equivalent.
Voltohmmeter.	Resistance ranges up to 5 megohms (meg); voltage ranges up to 300 volts in several scales, alternating current and direct current; input resistance, direct current, at least 10 meg. Use volt-ohmmeter I–107–(*), or equivalent. If volt-ohmmeter I–107–(*) is not available, make voltage measurements with a voltmeter having a sensitivity of at least 1,000 ohms per volt, and ranges up to 300 volts direct current, such as the voltmeter from Test Set I–56–(*), or equivalent. It is still essential to have an ohmmeter having ranges up to 5 meg.
Mounting FT–237–(*).	Connects Radio Receiver BC–603–(*) to a battery power supply and insures proper interconnection of the units when used in the complete radio sets. See figures 18 and 19 for view, and schematic diagram of Mounting FT–237–(*).
Capacitor.	0.006 microfarad (mf), 300 volts direct current with suitable clip connectors.
Resistor.	1,000 ohms, ½ watt, equipped with insulated clip connectors.
Tube checker.	Unit of Test Set I–56–(*), or equivalent.
Cord, CD–786.	Connects 12- or 24-volt battery to receiver.
Assorted hand tools.	
Brush.	Camel's-hair, ¼-inch round.
Solvent, dry-cleaning	
Bellows.	Small, hand-operated.
Signal generator.	Frequency-modulated (f-m), capable of operating in the 2- to 3-mc band, and in the 20.0- to 28.0-mc band. The audio frequencies available for modulation should be 150, 400, 1,000, 2,500, and 5,000 cycles per second. The signal generator should be capable of supplying the above audio frequencies directly. If an f-m signal generator is not available, one of the following substitutes which is listed in the order of preference may be used: Radio Receiver BC–603–(*) in good condition, or another f-m receiver in good condition, capable of operating in the frequency range from 20.0- to 28.0-mc and capable of supplying an intermediate frequency of 2.65-mc. Radio Transmitter BC–604–(*) in good condition, or another f-m transmitter in good condition, capable of operating in the frequency range from 20.0- to 28.0-mc and capable of a frequency division of at least 75 kc. An amplitude-modulated (a-m) signal generator capable of operating in the 2- to 3-mc band, and in the 20.0- to 28.0-mc band.

7. Removal of Tubes

a. Remove the dust cover as directed in paragraph 8.

b. The space around a vacuum tube is often limited. (See figs. 5 and 11.) Therefore, use a tube extractor or with the fingers rock the tube gently while pulling up.

Note. Immediately upon removal, label each tube clearly so that it can later be replaced in the socket from which it was taken.

8. Removal of Chassis Parts

The removal of the cover, dynamotor, fuses, and CALL SIGNAL lamp is described below.

a. Cover Removal. Place the receiver, panel downward, on a smooth surface. Turn the Dzus fastener at the rear of the cover one-quarter revolution counterclockwise and then slide the cover off.

b. Dynamotor Removal. Release the four mounting bolts in the corners of the dynamotor mounting plate (fig. 8) and lift the dynamotor (figs. 6 and 7) from the receiver.

c. Fuse Removal. Two fuses, labeled FUSE and SPARE, are located within the panel guard, below the speaker. (See figs. 1 and 7.) Remove the fuses by inserting a screw driver in the slotted fuse holders and turning counterclockwise. The fuses can easily be extracted from their holding sleeves.

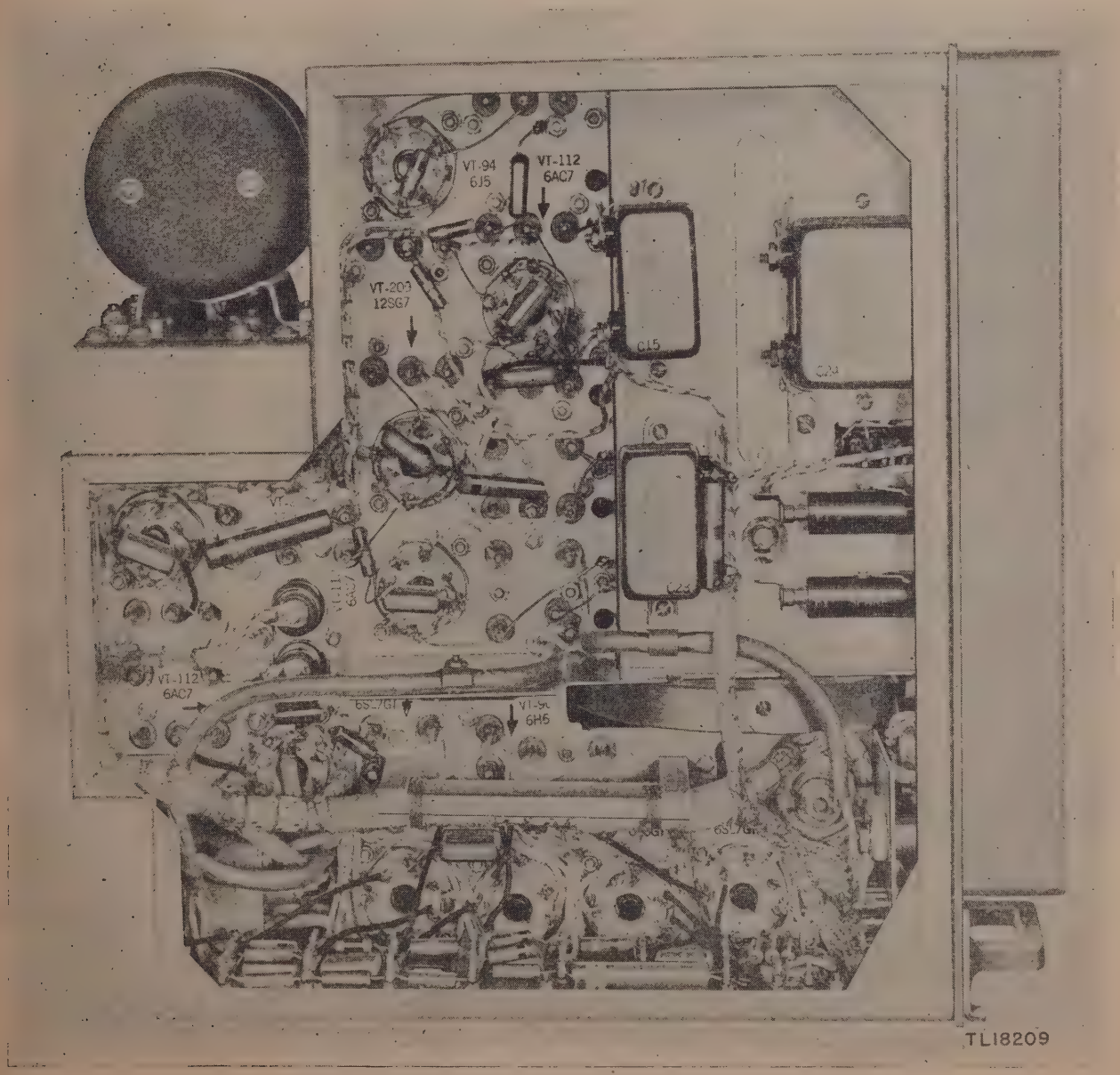


Figure 4. Radio Receiver BC–603–(*)—left-side interior view.

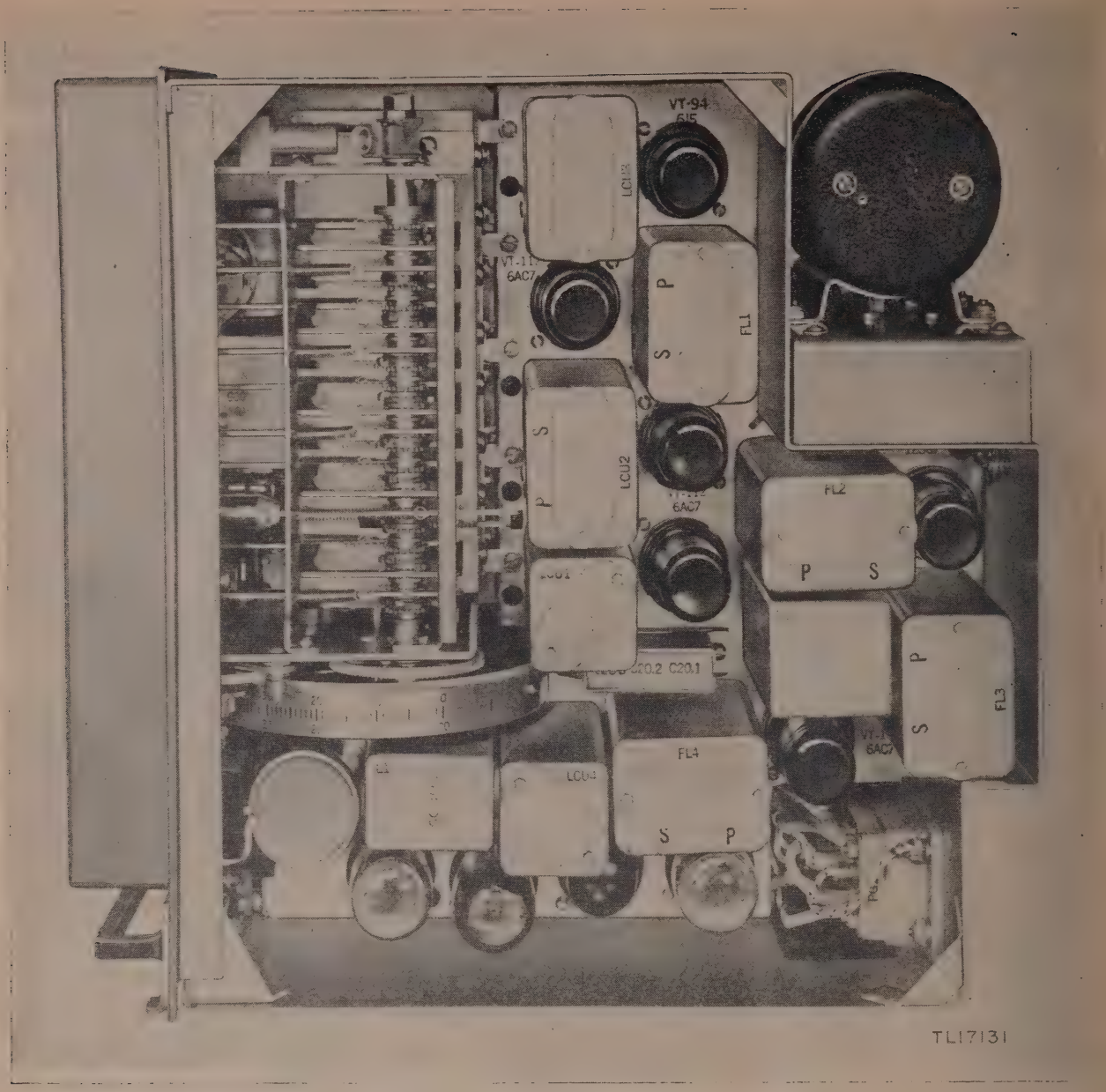


Figure 5. Radio Receiver BC–603–(*)—right-side interior view.

d. CALL SIGNAL. Lamp Removal. Unscrew the jewel guard of the CALL SIGNAL lamp on the front panel (fig. 9), and remove the bayonet-base lamp by pushing it in and turning it counterclockwise.

9. Cleaning, Inspecting, and Lubricating Chassis Assembly

a. General. While plug-in parts are out of the receiver, clean the receiver and its parts, and inspect for mechanical damage. (See *b* following.) Repair or replace damaged parts. Where special procedures are necessary see section IX.

b. Cleaning and Inspecting. (1) Remove the dust cover and see that the circuit label is firmly secured to the bottom.

(2) Clean the dust cover (inside and out), and the front panel with solvent dry-cleaning. Scrape off mud, tar, or any other adhering foreign matter. Touch up with paint or lacquer where necessary.

Caution: Do not use water or a water-moistened cloth on the panel or interior of the receiver.

(3) Clean and inspect plug PG1. (See figs. 2 and 11.) Make sure there is a slight play in the plug mounting. Clean the pins carefully with dry-cleaning solvent (SD) using the small camel's-hair brush. Use a small file to remove corrosion. Avoid scraping the bakelite insulation. If the plug is damaged or the pins are bent or broken, replace the plug as directed in section VIII.

(4) Clean and inspect dynamotor plug PG2 (fig. 10) in the same manner as in step (3) above, with one exception: this plug (PG2) must be tight and requires no play in the mounting.

(5) Shake or blow out any dust, loose dirt, sand, or gravel from the interior of the receiver, and remove hardened mud or any other foreign matter. Do not wipe parts on the chassis with a rag as this might cause damage. If corrosion is found, clean as completely as possible, being careful not to leave rust, metal scrapings, or filings in the set. Lacquer all parts that have been scraped clean. Replace parts whose operation has been affected by corrosion or rust.

Note. If an air hose is used, be sure that any water that may have condensed in it is blown out before applying the air stream to the equipment.

(6) Clean the vacuum-tube sockets and their pin receptacles (figs. 10 and 11) with dry-cleaning solvent (SD) and the camel's-hair brush. If the pin receptacles of any socket are bent or broken or if the socket is defective in any respect, replace the socket.

(7) Clean all accessible connections and grounding screws with dry-cleaning solvent and a tooth brush. In this visual and mechanical inspection solder or tighten all loose or broken connections.

(8) Check and tighten all accessible mechanical fasteners such as screws and bolts. Be sure vacuum-tube sockets are secure.

Note. Do not use excessive force when tightening screws.

(9) Dust off the push-button assembly (figs. 12 and 13) with compressed air or bellows. Check mechanical functioning to make sure the mechanism is operating freely and properly. If the push-button assembly is defective, repair or replace as directed in section VIII.

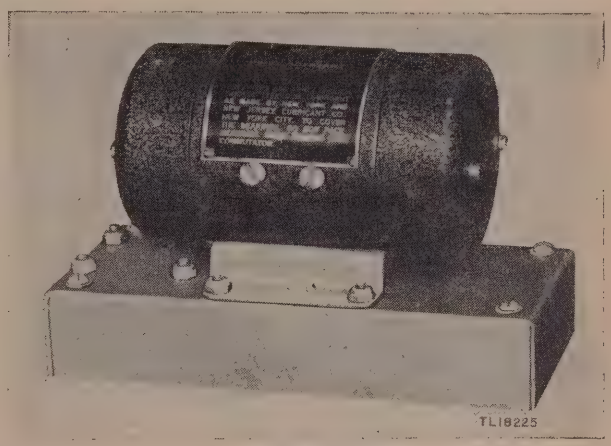


Figure 6. Dynamotor DM–34–(*) or Dynamotor DM–36–(*).

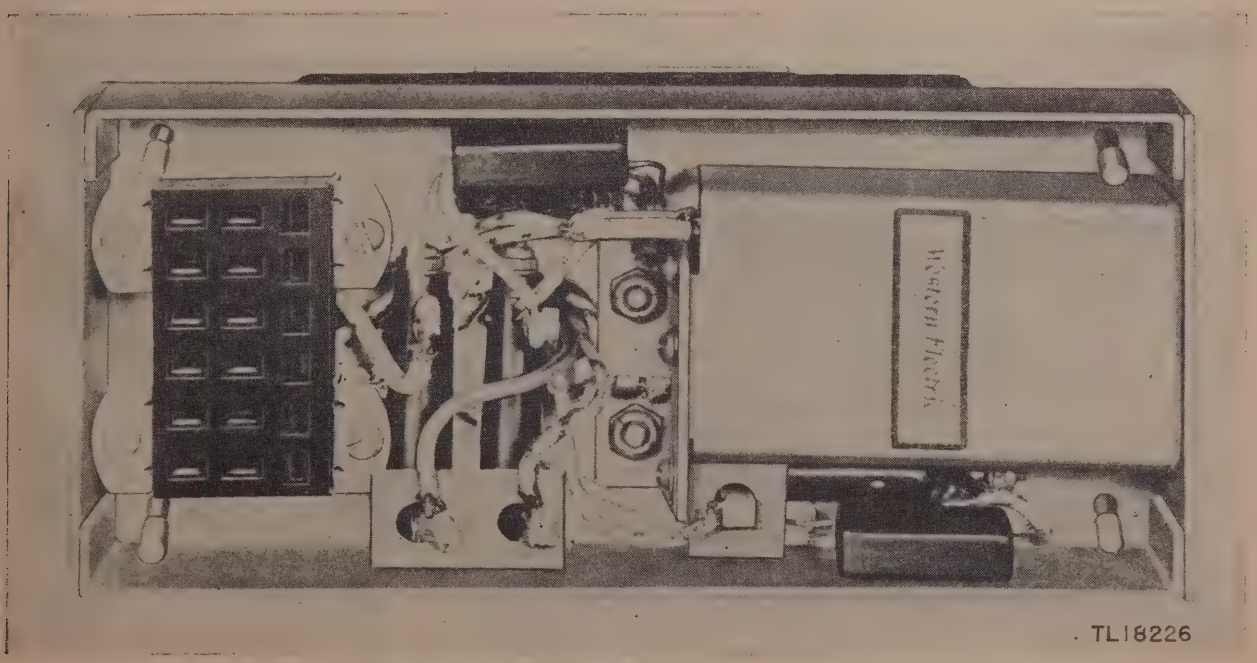


Figure 7. Dynamotor DM–34–(*) or Dynamotor DM–36–(*)—subbase view.

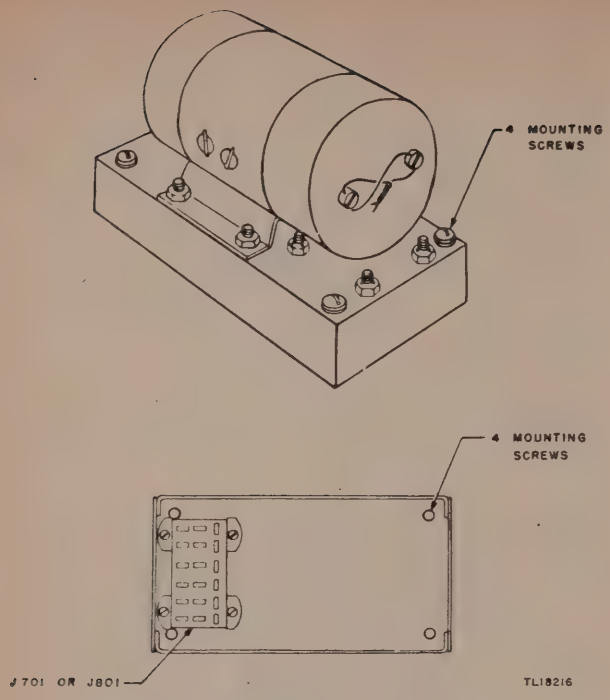


Figure 8. Dynamotor DM–34–(*) or Dynamotor DM–36–(*)—location of mounting bolts.

(10) Make sure all the vaccum-tube sockets, plugs, and other parts specified above are thoroughly clean and no hard deposits remain. Then apply the compressed air stream to remove any remaining dirt or particles of foreign matter.

(11) Inspect for broken parts and evidence of excessive heating and overloading, as indicated by burned resistors or melted wax.

Note. If any defects are apparent in step (11) above, locate components causing the above conditions by reference to section IV. Replace faulty parts, referring to section VIII in the event any specialized technique is required.

c. LUBRICATING. The only part requiring lubrication is the push-button assembly. Use oil, lubricating preservative special.

Caution: Use a minimum quantity of lubricant. Do not get special preservative lubricating oil (PS) on the locking wedge or friction washers.

(1) To apply a light film of special preservative lubricating oil (PS) (to the 10 push-buttons) (figs. 12 and 13), put 1 or 2 drops of the lubricant on each button, push in and then release.

(2) Apply 1 or 2 drops of special preservative lubricating oil (PS) (to the gear-rear shafts) top and bottom. (See fig. 14.)

(3) Coat the 10 push-button gear racks with a light film of special preservative lubricating oil (PS).

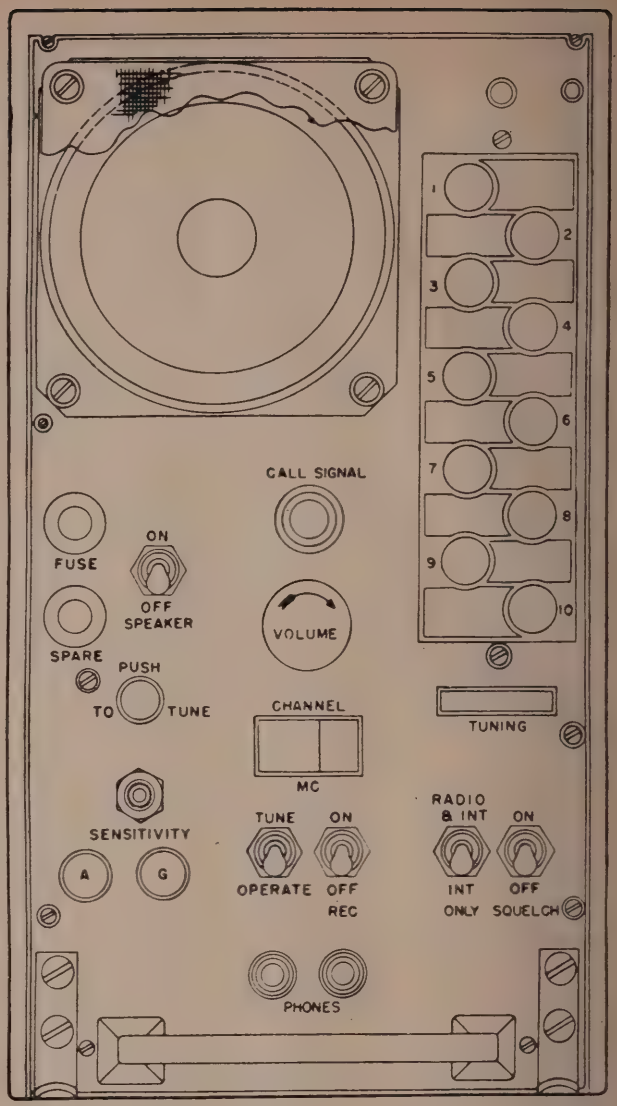


Figure 9. Radio Receiver BC–603–(*), apparatus location diagram—front view of panel.

(4) Lubricate the push-button gears. (See fig. 14.) Place one drop of special preservative lubricating oil (PS) between gears and spacers, above and below.

10. Cleaning, Inspecting, and Testing Removed Parts

a. VACUUM TUBES. (1) *Cleaning.* Handle tubes with care, and clean each with dry-cleaning solvent (SD) using the small camel's-hair brush. Remove remaining dirt and foreign matter from the pins and bases of the tubes.

Caution: Each good tube must eventually be returned to the socket from which it was taken. Do not interchange tubes.

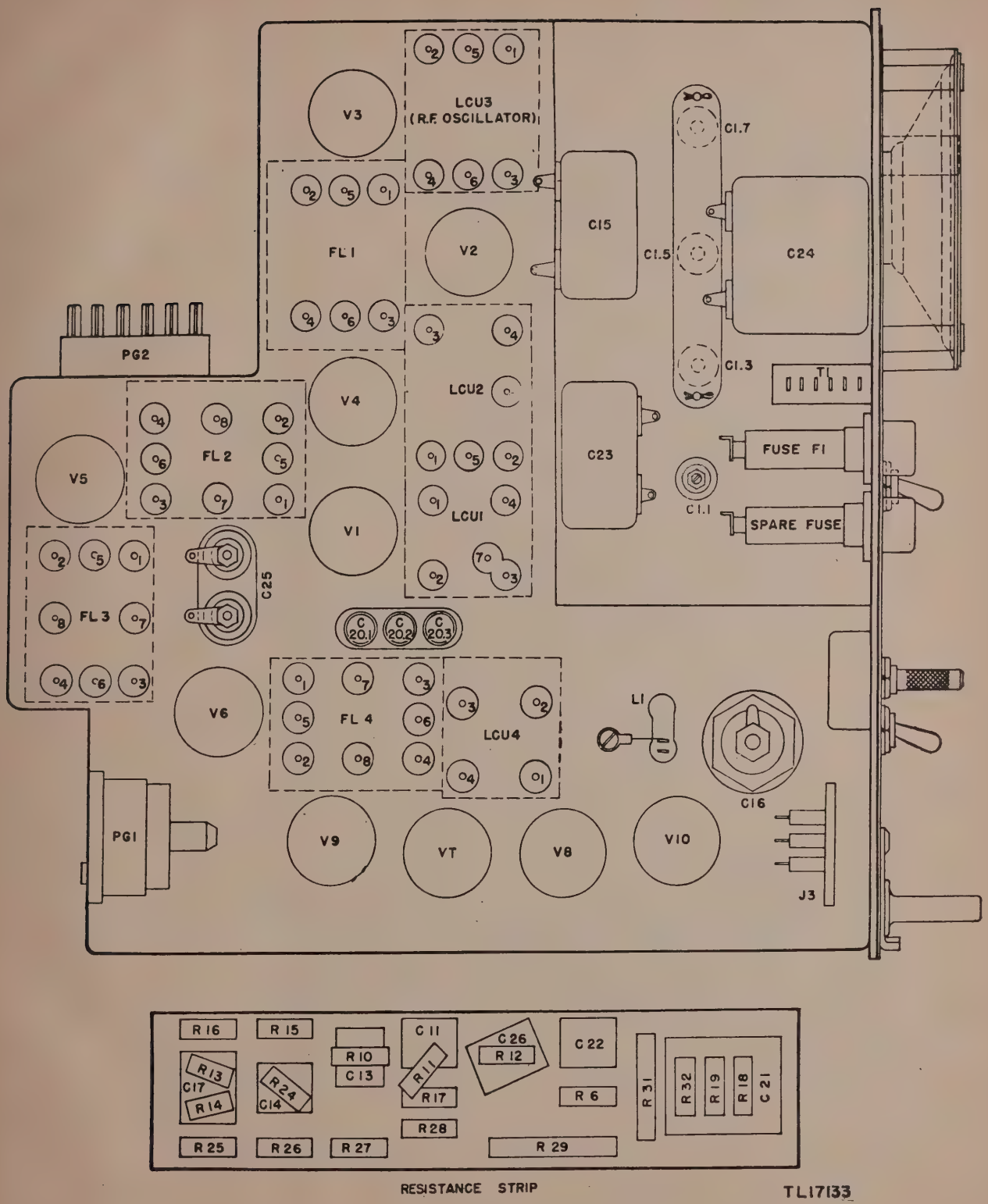


Figure 10. Radio Receiver BC–603–(*), apparatus location diagram—left-side view.

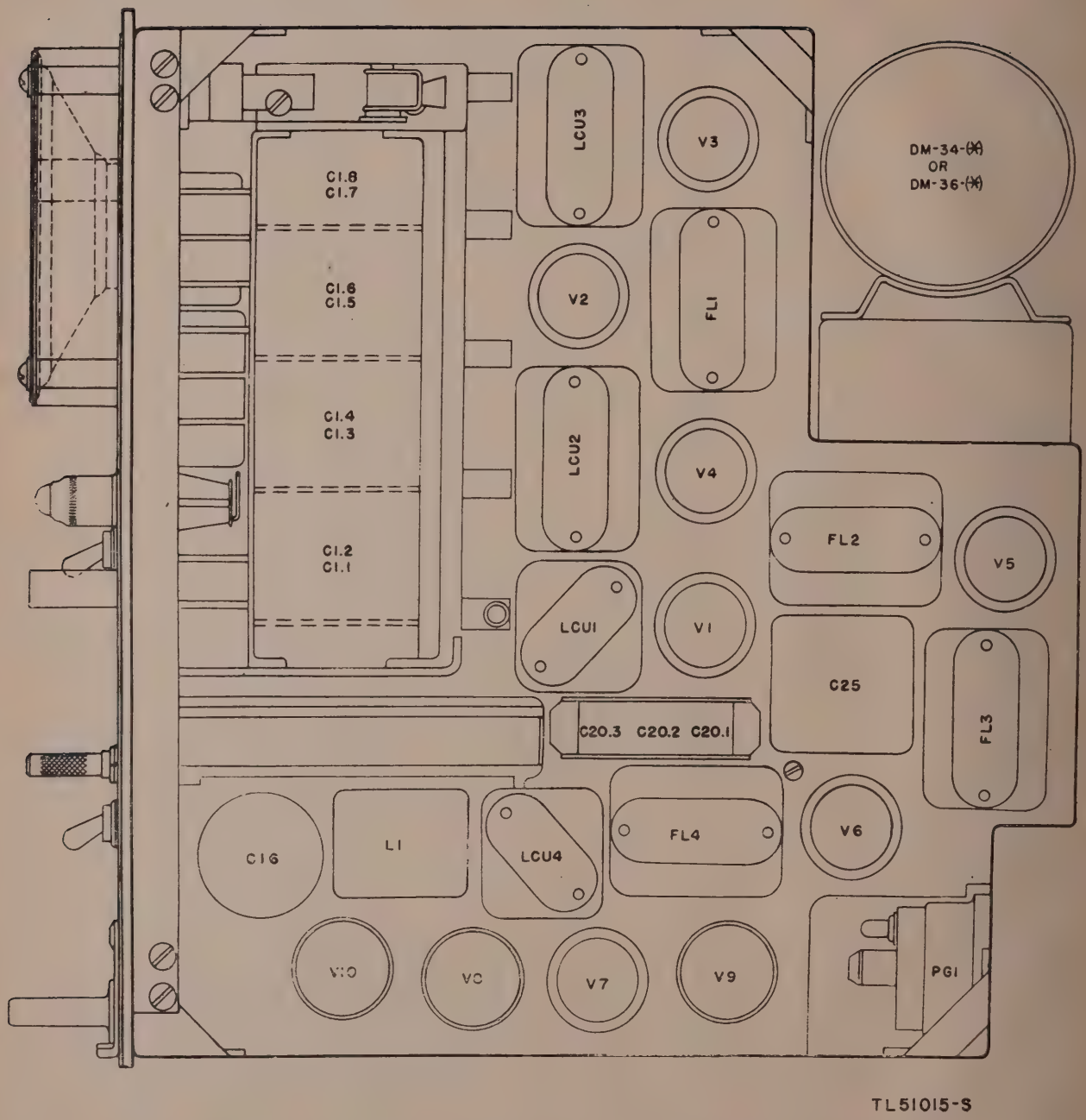


Figure 11. Radio Receiver BC–603–(*), apparatus location diagram—right-side view.

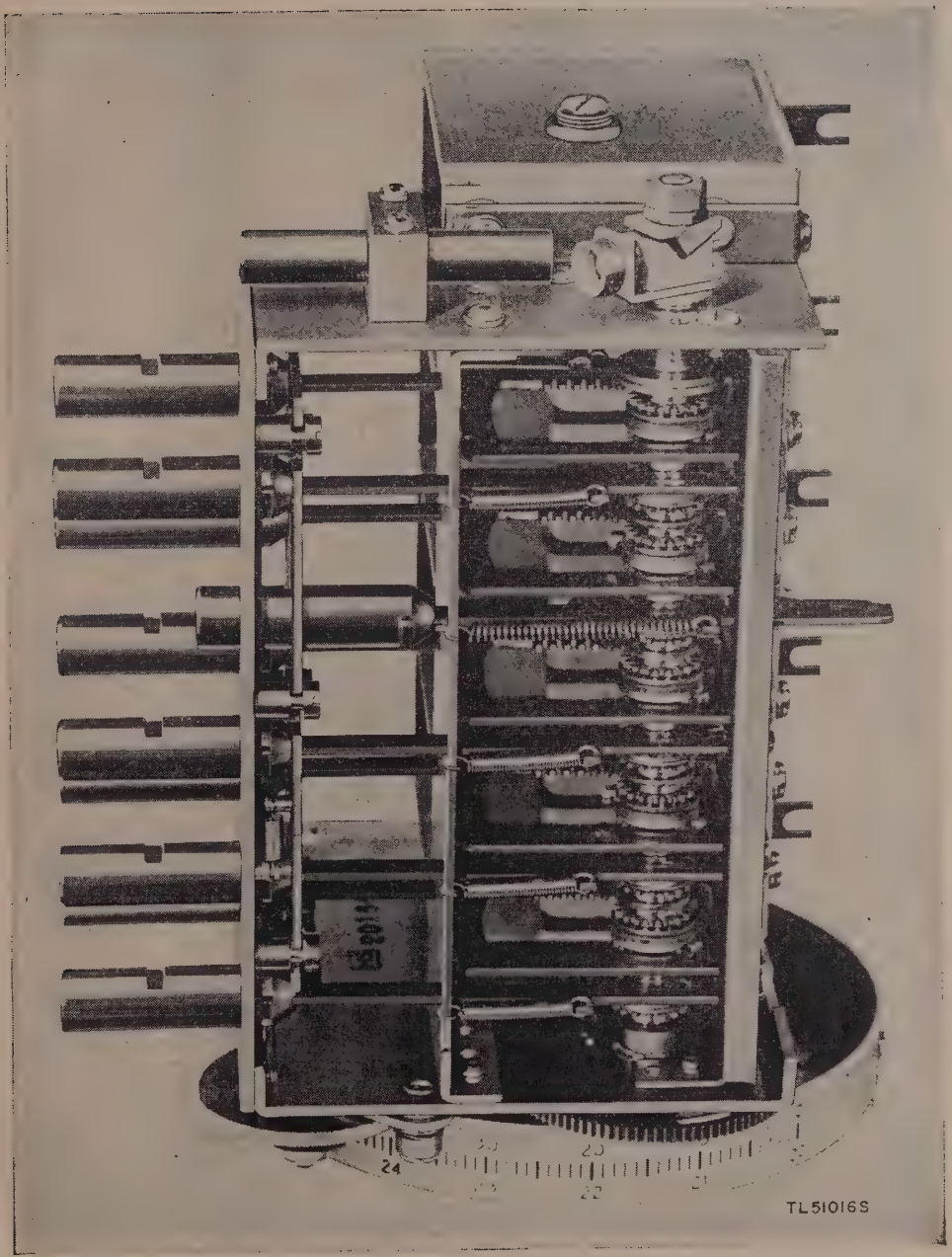


Figure 12. Radio Receiver BC–603–(*), push-button assembly—right-side view.

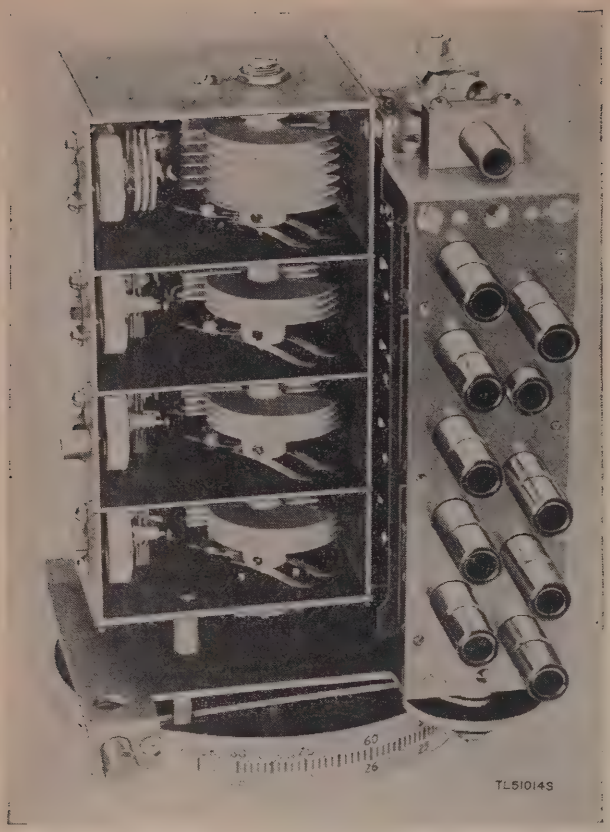
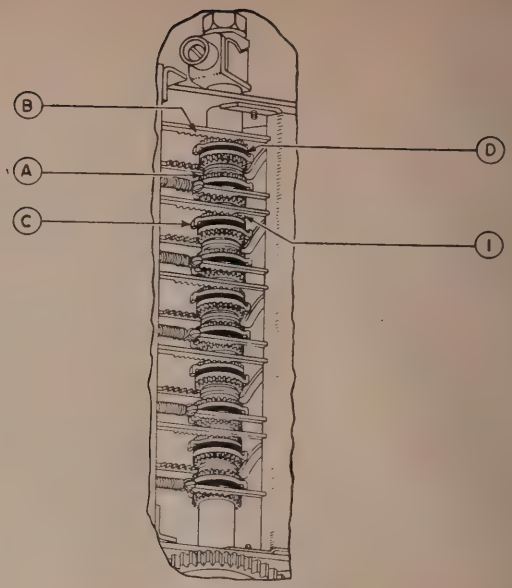


Figure 13. Radio Receiver BC–603–(*), push-button assembly—front view.



PARTS LIST	
A	GEAR
B	GEAR RACK
C	LOCKING WEDGE
D	FRICTION WASHER

SEQUENCE OF OPERATIONS	
STEP	OPERATION
I	APPLY ONE DROP OF OIL BETWEEN EACH OF THE TWENTY RACKS & GEARS

TL17104

Figure 14. Radio Receiver BC–603–(*), lubrication of push-button assembly.

(2) *Inspection.* Check the firmness of each tube in its socket, and inspect for mechanical and other obvious defects. Discard defective tubes. Make sure each tube is of the type specified.

(3) *Testing.* Test each tube in the tube checker unit of Test Set I–56–(*) in accordance with instructions furnished with the tube checker. Do not neglect the short-circuit test.

b. DYNAMOTOR. Clean, inspect, lubricate, and repair (when required) in accordance with instructions contained in TB SIG 134, or Repair Instructions for Dynamotors, Section R–434.01 (the latter may be obtained from fourth and fifth echelon Signal Corps repair shops). Test dynamotor for proper operation with dynamotor Test Set I–199 (or equivalent). If the dynamotor is found defective, repair it or replace it with a good one.

c. FUSES (fig. 1). (1) *Cleaning.* Clean two fuses FU–24 with dry-cleaning solvent (SD), removing all dirt and corrosion from contacts.

(2) *Inspecting.* Make sure the fuses are firmly held in their holders, and are in good mechanical condition. Check the number of fuses in the spare fuse bag attached to the receiver. There should be eight running spares, if any are missing, replenish the supply.

(3) *Testing.* Test the continuity of each fuse. Discard open or defective fuses and replace with good fuses.

d. CALL SIGNAL LAMP (fig. 1). (1) *Cleaning.* Clean CALL SIGNAL lamp LM–63 and its protective jewel with dry-cleaning solvent (SD).

(2) *Inspecting.* Check to see that the lamp is held firmly in its socket. Make sure there are two running spare lamps LM–63 in the attached bag.

(3) *Testing.* Test the lamp. The striking voltage is approximately 70 volts. Discard the lamp if the test shows it to be defective. For example, if the striking voltage varies considerably from 70 volts, or if the bulb is loose in its base, the lamp should be discarded. Discard the jewel if it is broken or otherwise damaged.

SECTION IV

PRELIMINARY TROUBLE-SHOOTING PROCEDURES

11. General

The tests described in this section are preparatory to detailed trouble location and to alignment of the receiver. These tests locate possible sources of trouble, which if not corrected would further damage the receiver during operation. Tests are outlined for the receiver power circuits and the dynamotor.

12. Dynamotor Continuity Tests

Because of variations in methods of manufacturing, widely varying terminal to terminal internal resistance measurements are found in various dynamotors of the same type. For this reason the customary ohmmeter continuity tests cannot be depended upon to indicate the true operating condition of a dynamotor. Therefore, test the operation of DM–34–(*) or DM–36–(*) with dynamotor Test Set I–199 (or equivalent) to determine its condition. If found defective, repair it or replace it with a good dynamotor. Reference to figures 15 or 16 will aid when repairs are required.

13. Receiver Input Resistance Tests

a. Check the resistance from the pin of PG1 to ground. (See fig. 24.) This reading should indicate an open circuit.

b. Check the resistance between the terminals of plug PG2 and ground. These resistances should agree with the values shown in the voltage and resistance diagram, figure 24.

c. If the resistances found in the above tests differ radically from the specified values, a fault, which must be located and eliminated, exists in the power wiring.

(1) To locate the fault, trace through the associated wiring, starting with the pin at which an in-

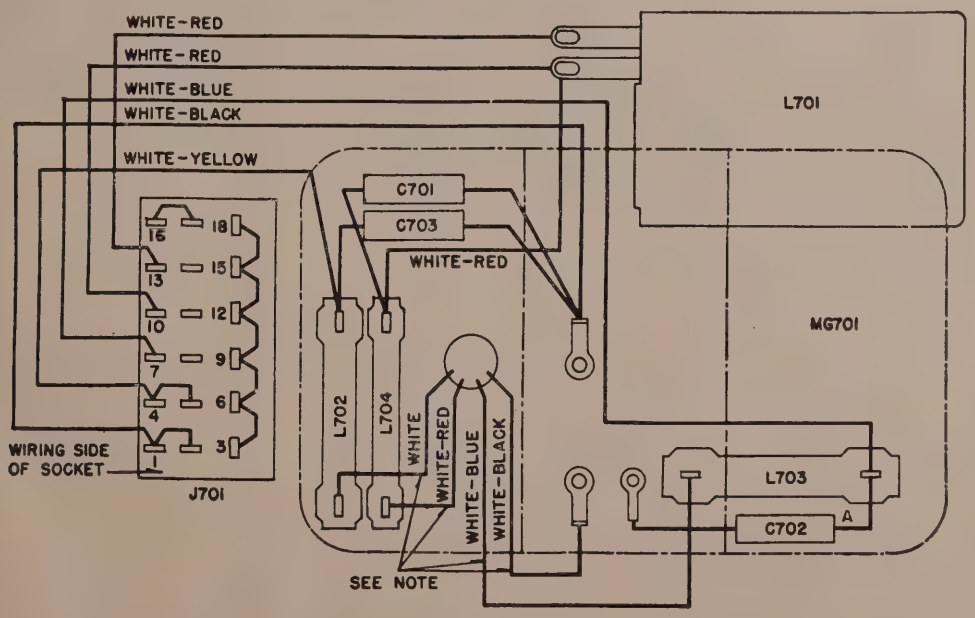


Figure 15. Dynamotor DM–34–(*)—wiring diagram.

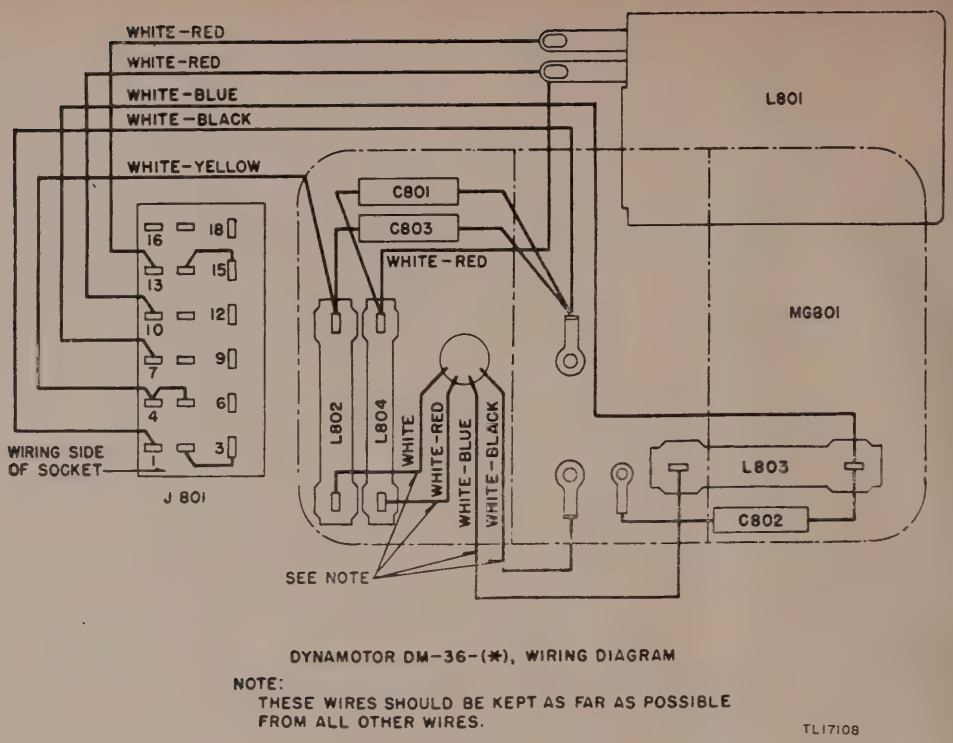


Figure 16. Dynamotor DM–36–(*)—wiring diagram.

correct value is noted. Check both visually and electrically for short circuits, open circuits, shorted capacitors, etc.

(2) When a faulty part is located, eliminate the cause of the failure, and repair or replace the faulty part. If special instructions are needed see section VIII.

14. Replacement of Removed Parts

a. CALL SIGNAL Lamp. Insert the CALL SIGNAL lamp in its socket and install its protective jewel. (See fig. 9.)

b. Fuses. Replace the fuses in their holder sleeves and turn them into place with a screw driver. (See fig. 1.)

c. Vacuum Tubes. Return the vacuum tubes to their respective sockets. (See figs. 5 and 11.)

Caution: Each good tube must be returned to the socket from which it was taken. Do not interchange tubes.

d. Dynamotor. Replace the dynamotor, making sure dynamotor jack J701 (or J801) mates properly with dynamotor plug PG2 on the receiver chassis. Fasten the dynamotor mounting bolts at the four corners of the dynamotor mounting plate. (See fig. 8.)

15. Operational Test

This test is intended to discover and localize any major defects so that they can be eliminated before continuing with the testing procedure.

a. Turn all receiver switches (fig. 9) to the OFF position.

b. Connect the receiver to the appropriate battery, using either mounting FT–237–(*) fig. 17 and Cord CD–786, or Adapter FT–384–(*). (See fig. 19.)

c. Throw the SPEAKER switch to ON.

d. Connect a voltmeter, having a range of at least 0 to 250 volts and a sensitivity of at least 1,000 ohms per volt, across capacitor C25. (See figs. 10 and 24*d* or *e*.) Be sure to connect the positive side of the meter to the terminal to which the wire with the red tracer is attached. Throw the RECEIVER ON—OFF switch to ON. Note that the meter indication rises immediately to approximately 200 volts when the switch is turned on. If it does not, turn the set off quickly and check capacitors C25 and C16 (fig. 10) for a possible short circuit. Also check the voltage divider, the dynamotor and the associated equipment. A low reading of the voltmeter may be indicative of a faulty dynamotor, or of a short circuit in the system. Locate, if possible, the cause of any faulty condition by resistance check, visual inspection, etc., and make sure

that any such condition has been eliminated. Repair or substitute good parts for any defective parts.

e. If the dynamotor fails to start or if the fuse blows turn the RECEIVER ON—OFF switch off. Inspect both visually and electrically the dynamotor and associated equipment as well as the fuse, plug PG2, the filament wiring, etc. Repair or substitute good parts for all defective parts.

f. Assuming that the dynamotor starts correctly and that the voltage is satisfactory, inspect the inside of the receiver while the dynamotor is running. See that no sparks occur, that there are no shorted wires, and that no part is burning or smoldering. Turn the set off immediately and repair the fault if a trouble condition is indicated.

g. After the dynamotor has been running for a few minutes, feel the tubes cautiously to see if they are all warm. No other tube should be as hot as V8 (figs. 5 and 11), which is a VT–107–A (JAN–6V60T) tube. No tube should remain cold. If a tube remains cold after the others have warmed up, examine the wiring associated with the tube socket in question, examine the socket contacts, and test the associated circuits in accordance with the procedure outlined in this paragraph. If there is no wiring trouble and the tube does not warm up, test the tube, and substitute a good one in its place if it is defective.

h. Check the voltages at each terminal of V6 (limiter) as shown in figure 24. The values should be reasonably close to those specified for V6. Approximate agreement with those values indicates that normal voltages are being supplied to the tube.

16. Voltage and Resistance Check

After the set has been tested in operation, check the voltage and resistance at each point shown on the voltage and resistance diagram. (See fig. 24.) The values obtained should agree with the information contained on the voltage and resistance diagram. If the readings at any point differ radically from the specified readings, localize the trouble by checking the wiring and the individual parts, starting at the point in question. The trouble may be due to defective wiring, drops of solder, open or shorted resistors or capacitors, etc.

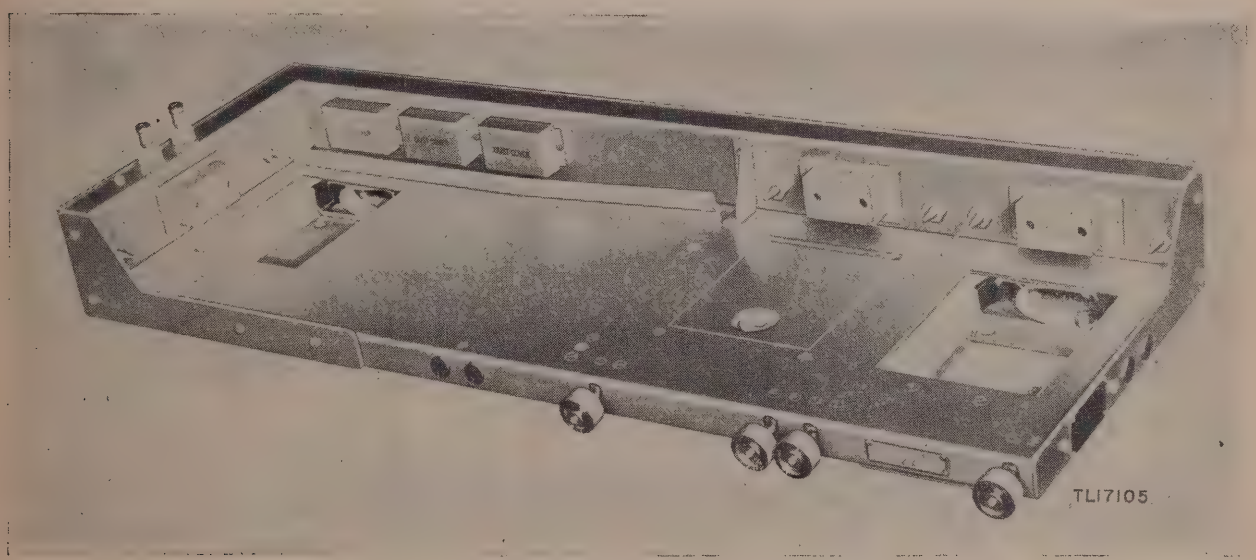
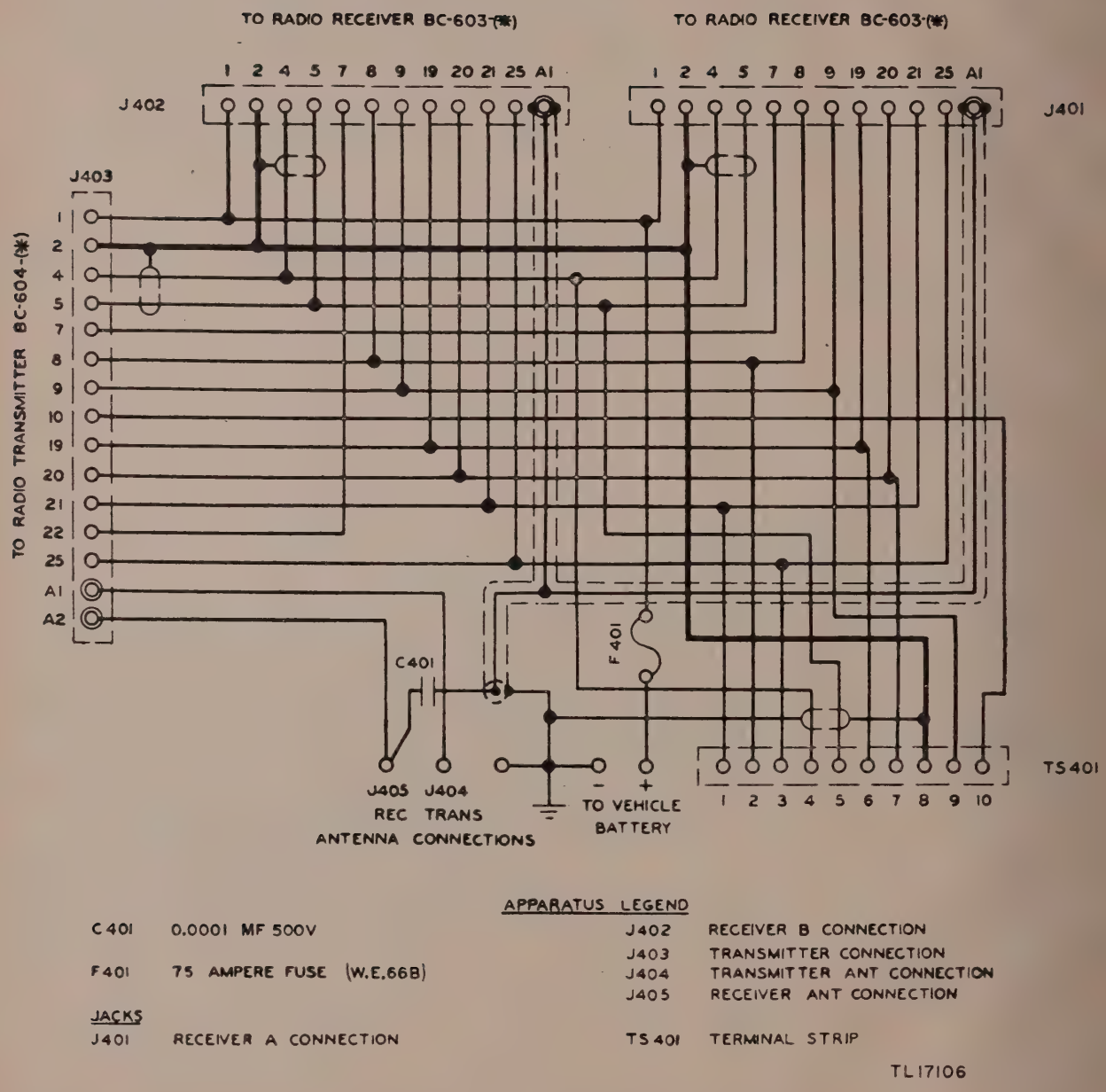


Figure 17. Mounting FT–237–(*)—oblique front view.



APPARATUS LEGEND

C401	0.0001 MF 500V	J402	RECEIVER B CONNECTION
		J403	TRANSMITTER CONNECTION
F401	75 AMPERE FUSE (W.E.66B)	J404	TRANSMITTER ANT CONNECTION
		J405	RECEIVER ANT CONNECTION
JACKS			
J401	RECEIVER A CONNECTION	TS401	TERMINAL STRIP

TL17106

Figure 18. Mounting FT-237-(*)—schematic diagram.

SECTION V

ALIGNMENT PROCEDURE

17. General

This section describes complete procedures for alignment of the receiver and for signal tracing.

a. Several alignment procedures are listed below in the order of preference, and are detailed below.

(1) The preferred method uses an f-m signal generator, with characteristics given in table I. This method permits alignment of all stages of the receiver.

(2) An a-m generator (table I) may also be used for alignment. This method permits alignment equal to that obtained with an f–m generator, but signal tracing *cannot* be accomplished with the a-m generator.

(3) Another receiver (table I) in good condition may be used as a signal source when neither an a-m nor an f-m signal generator is available, or when a voltmeter I–107–(*) is not available. This method permits alignment of all stages of the receiver. However, it is desirable to check the alignment against a signal generator as soon as possible.

(4) A transmitter (table I) in good condition may be used only when neither a signal generator nor a good receiver is available. Using this method, one or possibly two misaligned circuits in a receiver can be aligned with the remaining circuits. Alignment of the radio-frequency oscillator should not be attempted by this method. Any alignment made by this method must be checked against a signal generator as soon as possible.

b. Detailed trouble location is accomplished by means of signal tracing. Several signal tracing procedures are listed below in order of preference, and are detailed below.

(1) Use an f-m signal generator. This permits signal tracing through all stages of the receiver.

(2) If no f-m signal generator is available, a receiver (table I) in good condition may be used as a source of test signals for all stages of the trouble receiver.

(3) If neither an f-m signal generator nor a second receiver is available, a transmitter (table I) in good operating order may be used as a source for signal tracing in the audio-and radio-frequency stages; it does not, however, provide signals for tracing in the intermediate-frequency (i-f) stages.

(4) When none of the other signal sources is available, an a-m signal generator may be used for signal tracing through the discriminating stage, but not beyond. It permits a check of stage gains in the r-f and i-f stages, but cannot be used for those applications where a modulated signal is required.

18. Alignment Procedures

In the alignment procedure, regardless of the signal source used, align first the discriminator and i-f amplifier circuits, then the i-f amplifier, and last the r-f oscillator and r-f amplifier.

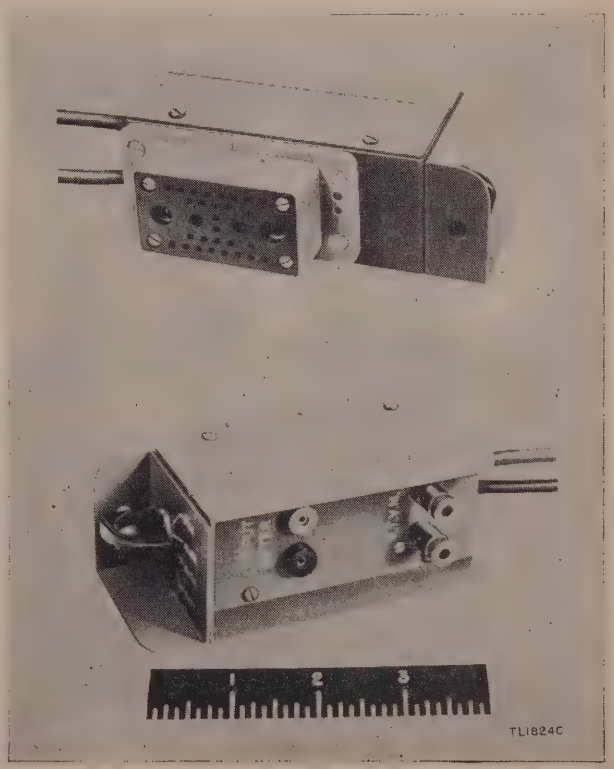


Figure 19. Adapter FT–384–(*)—front and back views.

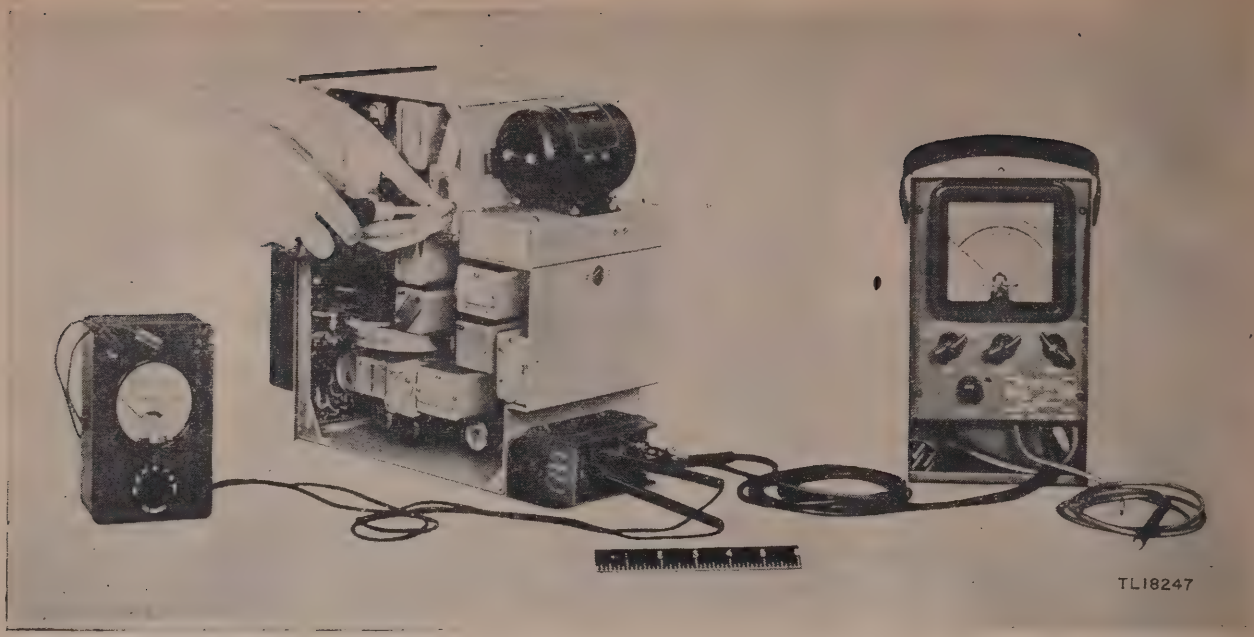


Figure 20. Adapter FT–384–(*), application to Radio Receiver BC–603–(*).

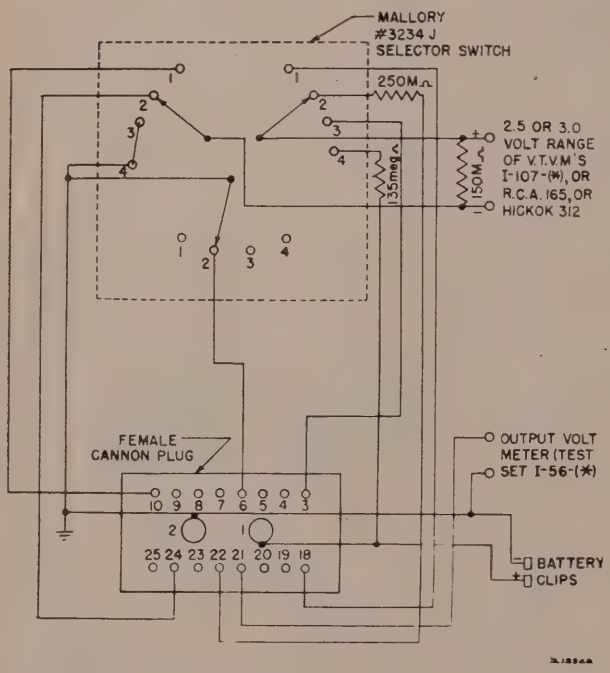


Figure 21. Adapter FT–384–(*)—schematic and wiring diagram.

19. Alignment Using an F-m Signal Generator

a. Alignment of Discriminator Circuit (FL4) and I-F Oscillator Circuit (LCU4) (fig. 31). (1) Remove the dust cover from the receiver.

(2) Make sure that a dynamotor of the correct primary voltage rating is in place.

(3) By removing the cottor pin at one end, loosen the cover plates from LCU1, LCU2, FL1, FL2, FL3, FL4, and LCU4.

Caution: Do not remove the cover from LCU3 (or from LCU3B, if this coil is present as a substitute for LCU3).

(4) Set the receiver controls as follows: The SPEAKER switch at ON, the SENSITIVITY and VOLUME controls to the extreme right, the TUNE-OPERATOR switch at OPERATE, the REC switch at OFF (until ready), the SQUELCH switch at OFF, and the RADIO & INT — INT ONLY switch at RADIO & INT.

(5) Prepare volt-ohmmeter I–107–(*) for use as follows: Connect the battery plug attached to the short cable at the bottom of the volt ohmmeter to a Battery BA–40. Set the SELECTOR switch for —VOLTS and the RANGE switch for 3 V.D.C. Short the COMMON and D-C VOLTS leads together and turn the ZERO ADJ knob for zero indication on the meter. It is advisable to leave voltohmmeter I–107–(*) on for approximately 5 minutes before using it, to allow the zero adjustment of the meter to become stable. When connected, the volt-ohmmeter leads to the V.T. V. M. posts of Adapter FT–384–(*).

Note. When aligning the intermediate-frequency amplifier or discriminator, if no shielded room is available and disturbing interference from nearby electrical equipment is observed, this interference can be minimized by connecting a short strap lead from terminal 5 of V3 to C25 (the terminal to which blue-tracer wires are connected).

(6) Connect the high side of the signal generator output through the 0.006-microfarad (mf) capacitor to the limiter control grid (terminal 6 of FL3) and connect the low side of the generator to the chassis.

(7) Adjust the generator for an output of between 1.0 and 2 volts at 2.65 megacycles (mc).

(8) Plug Adapter FT–384–(*) into receptacle PG1 of the receiver and connect it to the battery. Turn the switch of the adapter to DISK (discriminator output voltage).

(9) Turn the receiver to ON and, after allowing sufficient time for the vacuum tubes to heat, adjust the secondary tuning screw in filter FL4 for zero current in the voltmeter. The meter should reverse polarity as S is varied to either side of the zero-current point. The selector switch of voltohmmeter I–107–(*) can be turned from —VOLTS to + VOLTS to note this effect. This is an accurate indication of frequency and can be used as a check during the test. A check may be made from time to time to make sure that this meter still reads zero. If it does not, the signal generator should be readjusted to restore the reading to zero.

(10) Throw the TUNE-OPERATE switch to TUNE. Adjust the slug in tuning unit LCU4 to zero beat Set the TUNE-OPERATE switch to OPERATE.

(11) Turn the switch of the adapter to ALIGN and adjust the primary adjusting screw in FL4 for maximum indication on the voltohmmeter.

(12) Restore the adapter switch to DISK and trim the secondary screw setting for zero meter current. Adjust the signal generator 50 kilocycles (kc) above and 50 kc below 2.65 mc. Make sure that the readings of the voltohmmeter are approximately the same, but of opposite polarity.

(13) Vary the signal generator frequency *above* 2.65 mc until the test meter deflection is greatest. Note the meter reading and the generator frequency. The frequency should be between 2.725 and 2.745 mc.

(14) Vary the signal generator frequency *below* 2.65 mc until the test meter deflection is greatest. Note the meter reading and generator frequency. The meter reading should be within 0.75 volts of the reading in step (13) above, and the frequency should be between 2.560 and 2.580 mc.

(15) Place the switch of the adapter at CATH, with the signal generator set for 1.0-volt output at 2.65 mc, and note the reading of the voltohmmeter for later use in testing the intermediate-frequency amplifier.

b. Alignment of I-F Amplifier (fig. 44). (1) Reduce the signal generator output to zero and connect its shielded cord to the control grid of the modulator (terminal 4 of V2).

Note. Exposed unshielded wires are undesirable since they introduce unwanted pick-up and make alignment difficult, if not impossible. They should be kept as short as possible, preferably less than 2 inches, including the clip.

(2) Adjust the generator to a small output at 2.65 mc. Make sure the output of the intermediate-frequency oscillator is in zero-beat with the signal generator when the TUNE-OPERATE switch is set at TUNE. Then restore the switch to OPERATE.

(3) With the switch of the adapter at CATH, increase the generator output sufficiently to cause a reading of 0.9 volts on the voltohmmeter. Adjust the generator output from time to time during the following alignment to maintain a meter reading of between 0.6 and 0.9 volt.

(4) Connect the 1,000-ohm resistor between terminals 3 and 4 of filter unit FL3 and adjust the primary of FL3, designated P, for maximum voltmeter indication.

(5) Connect the resistor between terminals 1 and 2 of FL3 and tune the secondary of FL3, designated S, for maximum voltmeter indication.

(6) Repeat steps (4) and (5) above for filter units FL2 and plug FL1, respectively. Upon completion of those adjustments, note the signal generator output required to obtain the same meter deflection as in *a*(15) above. It should not be necessary to increase the signal generator output beyond 50 microvolts (mv) to obtain this reading.

(7) Vary the signal generator frequency through the 2.65-mc setting, and note that the selectivity is approximately symmetrical about the midfrequency.

(8) Adjust the generator frequency to 2.65 mc, and the generator output as required for a meter reading of 0.9 volt.

(9) Double the signal generator output voltage (6 decibels (db) increase), and determine the frequencies above and below 2.65 mc at which 0.9 volt is obtained. The band width between the two 6 db down frequencies should not be less than 75 kc, and the midband frequency should be within 5 kc of 2.65 mc.

(10) Repeat steps (8) and (9) for 1,000-fold voltage increase (60 db) of generator output The band width between the two 60 db down frequencies shall not exceed 350 kc.

(11) Remove the strap between C25 and terminal 5 of V3.

c. Alignment of R-F Oscillator (LCU3 or LCU3B) and R-F Amplifier Circuits (LCU1 and LCU2). (1) Reduce the signal generator output to zero and connect its shielded output cord with short leads directly to the A and G binding posts on the receiver.

Note. This is a test through the whole receiver except the connections from front binding posts A and G to the regular terminals A and G in plug PG1. Check for continuity between these two sets of terminals.

(2) Rotate the tuning dial to the stop at the 20-mc end of the scale. The reference line on the dial should be in approximate alignment with the tuning index. If the error is 1/16 inch or more, repair the unit. This involves removing the front panel and adjusting the glass with the hair line on it. It should be done only if unavoidable.

(3) Adjust the dial and the signal generator to 28.0 mc.

(4) Loosen the cover plate (near C24) from C1.3, C1.5, and C1.7. If the r-f oscillator tuned unit is LCU3, loosen its cover plate; if, however, the r-f oscillator tuned unit is LCU3B, then it should seldom be necessary to adjust the unit during the alignment procedure since LCU3B has been preset at the factory.

Caution: The LCU3B unit is sealed against moisture. Do not remove the cap unless absolutely necessary. Should it become essential to make a slug adjustment on the LCU3B, proceed as follows:

(*a*) Find as dry a place as possible.

(*b*) Run the receiver about 1 hour with the dust cover in place to warm the unit.

(*c*) To remove the cap, heat the single point solder seal of the cap with a soldering iron while exerting a turning action in the cap.

(*d*) Complete the alignment as quickly as possible.

(*e*) Replace the cap and resolder in place.

(*f*) If the cap was off for more than 5 minutes, run the receiver at least 1 hour with the dust cover in place and the cap off the unit.

(*g*) Remove the dust cover, replace the cap and resolder.

(5) Turn the switch of Adapter FT–384–(*) to DISK.

(6) Place the TUNE-OPERATE switch of the receiver at TUNE.

(7) Adjust trimmer C1.7 for zero beat in the loudspeaker. The (discriminator) voltmeter should read zero when the frequency is correct. This is an additional check on the frequency of the intermediate-frequency oscillator.

(8) Set the signal generator and the receiver dial at 20 mc, and adjust the slug in LCU3 or LCU3B for zero-beat.

(9) Repeat steps (7) and (8) above until the oscillator tracks satisfactorily at both ends of the band.

(10) When the oscillator is satisfactory at both ends of the band, check the 26-, 24-, and 22-mc points. Zero beat should be obtained within one-half dial division at each of these frequencies. If tracking at these frequencies is not satisfactory repeat step (7) above using 27 mc and step (8) above using 21 mc. After the dial tracking is regarded as satisfactory, take care to avoid touching C1.7 and the slug of LCU3 (or LCU3B) when making further adjustments.

(11) Turn the switch of Adapter FT–384–(*) to CATHODE and restore the TUNE-OPERATE switch to OPERATE.

(12) Increase the signal generator output sufficiently to cause a meter reading of 0.9 volt. Adjust the generator during the course of the following procedure to maintain a reading of between 0.6 and 0.9 volt on the meter.

Note. During the final alignment adjustments it is usually impossible to keep the meter deflection below 0.9 volt by reducing generator output. Under these conditions modulate the generator with 400 cycles and a frequency swing of 15 kc. Connect the output meter of Test Set I–56–(*) to Adapter FT–384–(*), and supplement the test meter deflection by observing the output meter deflection.

(13) With the signal generator at 28 mc, tune the receiver dial for zero beat at 28 mc. Adjust, in turn, trimmer capacitors C1.5, C1.3, and C1.1 for maximum test meter deflection.

(14) Adjust the generator and the receiver to 20.0 megacycles as in step (13) above.

(15) Adjust, in turn, the slugs in the LCU1 and LCU2 shield cans for maximum deflection of the meter.

(16) Readjust the trimmer capacitors at 28.0 mc, and the inductance trimmers at 20.0 mc alternately until no further improvement can be obtained.

20. Alignment Using an A-M Signal Generator (fig. 44)

When only an a-m signal generator is available for alignment, the procedure is exactly as given in paragraph 19 for the f-m signal generator, except that the procedure outlined in the note to paragraph 19*c*(12) cannot be carried out.

21. Alignment Using a Good Receiver (fig. 44)

When a Radio Receiver BC–603–(*) is found to be misaligned it can be put into serviceable condition if another receiver, either BC–603–(*) or one supplying the same r-f and i-f signals, is available. Alignment by this method must be checked as soon as possible in accordance with the procedure described in paragraph 19.

a. Preliminary Steps. The following steps in receiver alignment are divided functionally for convenience in description and understanding, but remember that in most cases a change in the alignment of any of the parts involves checking the adjustment of the other parts. The receiver under test will be referred to as the trouble receiver in the following discussion.

(1) Remove the covers from both receivers.

(2) Place all switches at OFF in both sets.

(3) Secure the good receiver in the right-hand position of Mounting FT–237–(*), and apply power to the trouble receiver by means of Cord CD–786, or equivalent.

(4) Turn both sets on, and set the TUNE-OPERATE switches at TUNE.

(5) Allow both sets 10 to 15 minutes to warm up.

(6) Connect both chassis together using one wire of the twisted pair as listed in table I. Use the wire which does *not* have the capacitor in series.

b. Alignment of I-F Oscillator and I-F Amplifier. (1) Short-circuit R14 of the trouble receiver. Connect terminal 5 of tube V3 to capacitor C25, the side to which blue-tracer wires are attached.

Note. It may be necessary to turn the SQUELCH switch to ON, and to adjust the SENSITIVITY control to obtain a usable reading on the voltmeter, when tuning the FL units.

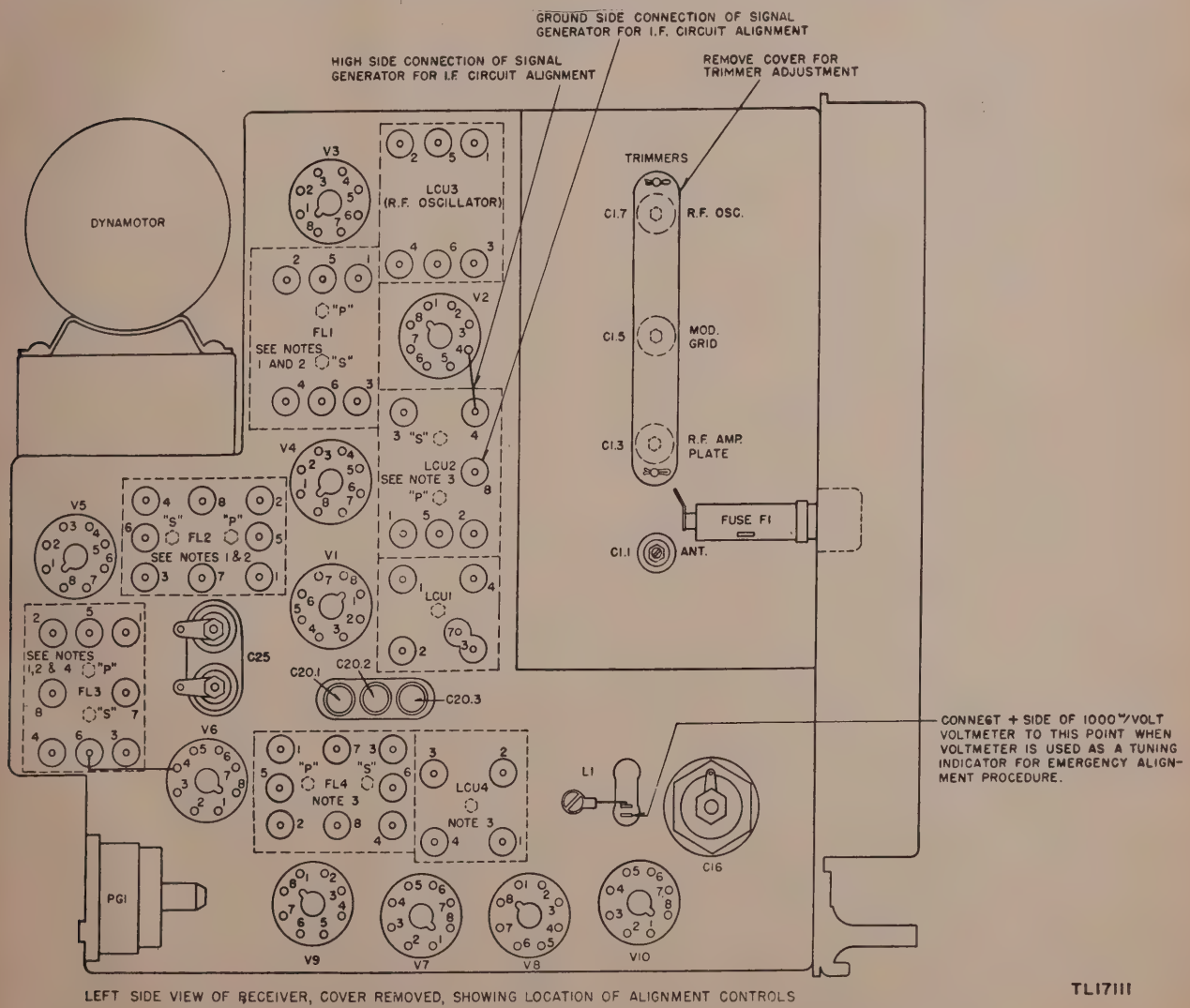


Figure 22. Radio Receiver BC–603–(*), location of alignment and tuning controls.

(2) Short-circuit terminals 1 and 2 of FL3 of the good receiver with a short clip lead.

(3) Connect terminal 7 of FL4 in the good receiver, through the capacitor which is in series with the remaining wire of the twisted pair, to terminal 4 of tube V2 in the trouble receiver. The untwisted part at the ends of the pair of wires should be as short as possible, and the capacitor should be nearest to the good receiver.

(4) Place the SPEAKER switch of the trouble receiver at ON.

(5) Clip a voltmeter across L1 of the trouble receiver. Attach the minus side of the voltmeter to the ground lug. (See fig. 22.) Use the 3-volt scale of voltmeter listed in table I.

(6) If the receiver is seriously misaligned, obtain a rough adjustment by adjusting the slugs in FL3, FL2, and FL1, in that order, for maximum meter reading.

Note. If no change in meter reading is observed when the slugs of FL3 are adjusted, turn the good receiver off and on, and note the deflection of the meter. If this does not cause any change in deflection, the trouble receiver may be faulty and require service. If the deflection is too small for satisfactory reading, the connection at terminal 7 of FL4 (in the good receiver) should be moved to terminal 2 of FL4 to obtain a larger reading for the preliminary adjustment. After the preliminary adjustment it should be returned to terminal 7 of FL4 which gives a signal strength more appropriate for the subsequent tests.

Caution: The lockwashers on the tuning slugs of the tuned circuits may be damaged by turning the slugs in too far. When any adjustment of these units is made, make sure that the tuning slugs bind sufficiently to insure permanency of setting. If they feel loose during adjustment, tighten the lockwashers by turning them to the right with a small screw driver.

(7) Align LCU4 of the trouble receiver for zero beat and turn the TUNE-OPERATE switch to OPERATE.

(8) Clip a 1,000-ohm resistor across terminals 3 and 4 of FL3. Adjust the primary slug (P) for maximum meter reading.

(9) Remove the 1,000-ohm resistor and clip it across terminals 1 and 2 of FL3. Adjust the secondary slug (S) for maximum meter reading.

(10) Repeat step (8) above for FL2.

(11) Repeat step (9) above for FL2.

(12) Repeat step (10) above for FL1.

(13) Repeat step (11) above for FL1, and remove the 1,000-ohm resistor when the alignment is completed.

Note. Check all adjustments, especially that of LCU4.

c. Alignment of Discriminator Circuit (FL4). (1) Remove the meter and bridge it across terminals 3 and 4 of FL4. Polarity of the meter cannot be specified as it will depend on the adjustment.

(2) Align the secondary of FL4 for zero reading. Note that as the slug is varied in either direction from the zero reading, the alignment meter should move *up* scale for one direction and *down* scale for the other.

(3) Remove the short from R14, and ground terminal 1 of FL4.

(4) Place the 1,000-ohm shunt between terminals 3 and 4 of FL1.

(5) Remove the meter and connect it between terminals 2 and 3 of LCU3, the positive lead going to terminal 3. It may be necessary to use the 30-volt scale.

(6) Align the primary of FL4 for minimum meter reading.

(7) Remove both the 1,000-ohm shunt and the meter.

(8) Remove the short between C25 and terminal 5 of tube V3.

(9) Remove the lead from terminal 4 of tube V2 of the trouble receiver, and from terminal 7 of FL4 of the good receiver.

(10) Remove the short between terminal 1 of FL4 and ground.

d. Alignment of R-F Oscillator, Assuming Intermediate Frequency to be Exactly 2.65 mc. The r-f oscillator of the good receiver is used to provide an r-f signal for testing the trouble receiver. The frequency of this r-f will be 2.65 mc above that indicated on the dial of the good receiver.

(1) Bridge the meter across L1, with the negative terminal connected to ground.

(2) Place a short across resistor R14.

(3) Place the TUNE-OPERATE switch of the trouble receiver at TUNE, and place the TUNE-OPERATE switch of the good receiver at OPERATE.

(4) Assuming the intermediate frequency to be 2.65 mc, set the good receiver at (28.0—2.65) 25.35 mc, and the trouble receiver at 28.0 mc.

(5) Adjust radio-frequency oscillator-trimmer capacitor C1.7 of the trouble receiver to give zero beat in the loudspeaker.

(6) Set the good receiver at 20.0 mc and the trouble receiver at (20.0 + 2.65) 22.65 megacycles.

Adjust the slug in LCU3 for zero beat, or if LCU3B is present, adjust only if unavoidable.

(7) Repeat the two preceding steps until the radio-frequency oscillator tracks at both ends of the band.

e. Check of Intermediate Frequency and Readjustment of R-F Oscillator. If the intermediate frequency of the good receiver is not exactly 2.65 megacycles, a correction may readily be made.

Note. It may be necessary, in order to provide sufficient signal for these tests, to connect the bared end of a piece of insulated wire to post A of the trouble receiver, and extend the wire across the top of the good receiver to act as an antenna.

(1) Set the dial of the trouble receiver to 24 mc.

(2) Adjust the dial of the good receiver to give zero-beat at approximately 21.35 mc, and note the dial reading at which it occurs.

(3) Leaving the trouble receiver at 24 mc, retune the good receiver to obtain the (somewhat weaker) beat note between 26 and 27 mc. Note the dial reading.

(4) By subtraction, determine the difference between the two dial readings obtained in steps (2) and (3) above.

(5) Divide this difference by two.

(6) The value obtained in this way is the actual intermediate frequency.

(7) Repeat the alignment procedure as outlined in *d*(4) through (7) above for the radio-frequency oscillator, using this value in place of 2.65 mc.

(8) Make certain that the radio-frequency oscillator tracks at both ends of the band.

(9) Remove the short from terminals 1 and 2 of FL3 in the good receiver

(10) Replace the cover on the good receiver.

f. Adjusting LCU1 and LCU2. (1) In the trouble receiver, shunt a 1,000-ohm resistor between terminals 1 and 2 of FL1. Connect the 3-volt meter across L1, with the negative side on the ground lug. Short R14.

(2) Connect terminals 3 and 4 of LCU1 to ground, using the shortest wires.

(3) Set the dial of the trouble receiver at 28 mc.

(4) Tune the good receiver at approximately 25.35 mc to give a beat note in the loudspeaker.

(5) Align C1.1, C1.3, and C1.5 for maximum reading on the meter.

(6) Set the dial of the good receiver at 20 mc.

(7) Tune the trouble receiver at approximately 22.65 mc to give a beat note.

(8) Adjust the slugs in both the primary and secondary of LCU2, and the slug in LCU1 for maximum reading of the meter.

(9) Repeat steps (3) through (8) above until the units track at both ends of the band.

Note. The rough adjustment is completed when the procedure of step (9) above is accomplished.

(10) Turn the power switch of the good receiver to OFF. Turn the squelch switch of the good receiver to OFF. Remove the 1,000-ohm shunt from FL1 of the trouble receiver.

(11) Repeat the alignment steps for LCU1 and LCU2 using noise background alone for maximum meter reading at both ends of the dial (20 and 28 mc).

(12) Remove the short circuit from R14. Also remove the meter, and the short circuits from terminals 3 and 4 of LCU1 to ground.

(13) Replace all cover plates securely.

(14) Replace the dust cover.

22. Alignment Using a Good Transmitter (fig. 44)

One or possibly two misaligned circuits in Radio Receiver BC–603–(*) can be roughly aligned with the remaining circuits of the receiver by using a good transmitter, either BC–604–(*) or another supplying the same frequencies. Alignment of the radio-frequency oscillator should not be attempted by this method.

Note. The transmitter dynamotor should be operated only when signal is needed.

a. Alignment of I-F Oscillator. (1) Install the transmitter and receiver in Mounting FT–237–(*). Place the receiver in the right-hand position.

(2) Find the reduced-voltage points as follows:

(*a*) Connect the voltmeter across the limiter cathode choke with the minus (—) terminal of the meter connected to ground.

(*b*) Turn the SPEAKER switch to OFF, the TUNE-OPERATE switch to OPERATE, and throw the SQUELCH switch to OFF.

(*c*) With the transmitter operating on RECEIVER TUNE, manually tune the receiver dial for a maximum deflection of the voltmeter. Note the voltmeter reading and the dial setting.

(*d*) Carefully adjust the tuning dial to each side of the maximum voltmeter deflection until the voltmeter indicates three-fourths of the maximum deflection. Note the two dial readings obtained. These are the reduced-voltage points.

(*c*) Set the dial halfway between the two reduced-voltage points.

(3) Remove the cover plate for access to the adjusting screw in LCU4.

(4) Vary the setting of this screw until a beat note is heard. Carefully adjust for zero beat. This step brings the tuning unit LCU4 into alignment with the intermediate-frequency amplifier.

b. Alignment of I-F Amplifier (FL1, FL2, and FL3). (1) Install the transmitter and the receiver into Mounting FT–237–(*), with the receiver in the right-hand position.

(2) Connect the voltmeter (3-volt scale) across limiter cathode choke L1.

(3) Short-circuit resistor R14.

(4) Connect a 50-micromicrofarad (mmf) capacitor between terminals 1 and 2 of tuning unit LCU2. This capacitor reduces the input to the intermediate-frequency amplifier.

(5) Turn the receiver ON-OFF switch to ON; the TUNE-OPERATE switch to TUNE; the SPEAKER switch to ON; the SQUELCH switch to OFF; the volume control to the extreme right. Release the tuning dial by depressing one of the push-buttons part way.

(6) Adjust the transmitter to a channel near the 20-mc end of its frequency range. Turn the transmitter on. Place the RECEIVER TUNE-OPERATE switch at RECEIVER TUNE.

(7) After the receiver has had time to warm up, carefully adjust the receiver dial (use the same setting as on the transmitter) for zero beat with the transmitter signal. Note the maximum deflection of the voltmeter as the dial is tuned through the zero-beat point. The meter deflection should decrease as the dial is varied to either side of zero beat. Restore the zero-beat adjustment after completing the observation.

(8) Remove the capacitor from LCU2 and note the reading of the voltmeter. The voltmeter reading with the capacitor in place should be not more than three-fourths of the reading with the capacitor removed. If it is more, the capacitor leads are too long, the clips are not making contact, or the capacitor is too small. In the latter event, try a 75-mmf capacitor. Adjustment of the SENSITIVITY control may help to control the voltmeter reading.

(9) Replace the capacitor.

(10) Detune the receiver by several channels (to a point where no signals are being received) and note the minimum voltmeter reading. (The voltmeter is effective as a tuning indicator only if its deflection is kept between the minimum value and the three-fourths reading (step (8) above). Therefore, keep the deflection within this range at all times during this procedure.)

(11) Remove the cover plates from the tuning unit to be aligned, either FL1, FL2, or FL3.

(12) Adjust the primary and secondary adjusting screws of the tuning unit for a rough approximation of the maximum voltmeter deflection.

(13) Connect the 5,000-ohm resistor between terminals 3 and 4 of the tuning unit being adjusted.

(14) Adjust the primary screw for a maximum voltmeter reading.

Note. Check the zero-beat setting occasionally as the work progresses. Also, keep the voltmeter within the limits given in step (10) above by adjusting the SENSITIVITY control with the SQUELCH switch ON.

(15) Remove the resistor from terminals 3 and 4 and connect it between terminals 1 and 2.

(16) Adjust the secondary screw for maximum voltmeter reading.

(17) Remove the coil and the 5,000-ohm resistor.

c. Alignment of R-F Amplifier. Alignment of a radio-frequency tuning unit (LCU1 or LCU2) is accomplished as follows:

(1) Install the transmitter and the receiver in Mounting FT–237–(*), with the receiver in the right-hand position.

(2) Connect the voltmeter (3-volt scale) across limiter cathode choke L1, as shown in figure 22.

(3) Short-circuit resistor R14, using a short jumper wire.

(4) Connect the 100-mmp capacitor between terminals 1 and 2 of filter unit FL1.

(5) Remove the cover plates from tuning units LCU1 and LCU2, and from trimmer capacitors C1.3, C1.5, and C1.7. (The cover plate of C1.7 is beside C24.)

Caution: Do not disturb the setting of oscillator trimmer capacitor C1.7 during this alignment.

(6) Turn the SPEAKER switch to ON, set the TUNE-OPERATE switch to TUNE, and turn the SQUELCH switch to OFF. Turn the VOLUME and SENSITIVITY controls to the extreme right.

(7) Adjust the transmitter for operation near the 28-mc end of its frequency range. Place the transmitter in the RECEIVER TUNE condition. Start the transmitter and the receiver.

(8) After the receiver has warmed up, carefully adjust the receiver dial for zero beat with the trans-

mitter. (The receiver dial should read the frequency to which the transmitter is set.) Adjust each of the trimmer capacitors (C1.1, C1.3, and C1.5) for maximum voltmeter deflection. If the 100-mmf capacitor bridged across terminals 1 and 2 of FL1 has not reduced the signal strength (from the transmitter) sufficiently to obtain a good range of meter deflection, a further reduction may be obtained by connecting that capacitor across terminals 1 and 2 of either FL2 or FL3 instead of FL1. When the trimmers are properly set, the voltmeter deflection decreases as the set is detuned from the zero-beat point.

(9) Remove the 100-mmf capacitor from terminals 1 and 2 of the filter unit across which it is shunted. The voltmeter reading with the capacitor in place should be not more than three-fourths of the reading with the capacitor removed. If it is more, the capacitor leads are too long, or the clips are not making good contact.

(10) Replace the capacitor and trim the settings of C1.1, C1.3, and C1.5, if necessary.

(11) Operate the transmitter near the 20-mc end of its frequency range and carefully adjust the receiver to zero beat with the transmitter. The reading of the receiver dial should correspond with the transmitter frequency.

(12) Adjust the primary and secondary adjusting screws in tuning unit LCU2, and the single adjusting screw in LCU1, for maximum deflection of the voltmeter.

(13) Readjust the transmitter and receiver to the higher test frequency, and trim C1.1, C1.3, and C1.5 for maximum voltmeter deflection.

(14) Check back and forth between the two test frequencies, repeating steps (12) and (13) above until no further improvement can be made.

(15) Restore the receiver to normal. Connect the receiver to the antenna, and check the setting of the antenna trimmer capacitor by adjusting it again for maximum noise in the loudspeaker.

d. Alignment of Discriminator. Align a discriminator filter unit (FL4) in an emergency as follows:

(1) Install the transmitter and receiver in the mounting, with the receiver in the right-hand position.

(2) Connect the voltmeter (3-volt scale) across the limiter cathode choke, L1, as shown in figure 22.

(3) Short-circuit resistor R14, using a short jumper wire.

(4) Connect the 100–mmf capacitor between terminals 1 and 2 of filter unit FL2.

(5) Remove the cover plate from filter FL4.

(6) Turn the SPEAKER switch to ON, turn the TUNE-OPERATE switch to TUNE, and turn the SQUELCH switch to OFF. Turn the VOLUME control to the extreme right.

(7) Adjust the transmitter for operation near the 20-mc end of its frequency range. Place the transmitter in the RECEIVER TUNE condition. Start the transmitter and the receiver.

(8) After the receiver has warmed up, carefully adjust the receiver tuning dial for zero beat with the transmitter frequency. Observe that zero beat occurs at maximum deflection of the voltmeter, and note the maximum reading.

(9) Remove the capacitor from FL2, and note the new voltmeter reading. The voltmeter reading with the capacitor connected to FL2 should not exceed three-fourths of the reading with the capacitor removed. If it does, the capacitor leads are too long, or the clips are not making good contact.

(10) Reconnect the capacitor to terminals 1 and 2 of FL2.

(11) Ground terminal 1 of FL4 to the chassis with a short jumper wire. Remove the voltmeter from across L1 and connect it between terminals 3 and 7 of filter FL4 (using the 10-volt or 30-volt scale). Connect the terminal of the voltmeter to terminal 3 of the filter.

(12) Check the zero-beat setting of the dial while observing the voltmeter. The meter should read zero at zero beat, and reverse polarity as the receiver is tuned through the zero-beat point. If this is not the case, align the secondary by adjusting the secondary adjusting screw for zero voltmeter reading.

(13) Remove the voltmeter from FL4 and connect it (3–volt scale) between terminals 1 and 5 of tuning unit LCU2. Connect the terminal of the voltmeter to terminal 5 of LCU2. Remove the short circuit from resistor R14.

(14) Adjust the primary screw in filter FL4 for a minimum deflection of the voltmeter.

(15) Reconnect the voltmeter (10-volt or 30-volt scale) to terminals 3 and 7 of FL4, and recheck the adjustment of the secondary screw in FL4 as in step (13) above.

(16) Restore the receiver to normal.

SECTION VI

DETAILED TROUBLE-SHOOTING PROCEDURES

23. Signal Sources

a. GENERAL. Any of the signal sources listed in paragraph 18b may be used for signal tracing.

Caution: When connecting or disconnecting a signal source, turn the receiver off each time to avoid shock or equipment damage.

b. SUPPLEMENTARY METERS. An output meter plugged into one of the phone jacks, or an alignment meter bridged across L1, helps greatly in judging the performance of the receiver.

(1) The output meter should be connected as follows: Connect the plug and cord assembly of Test Set I–56–(*) to the ± and VM terminals of the output meter. Adjust the meter for the 15–volt scale, and insert the plug into one of the phone jacks of the receiver.

(2) The alignment voltmeter is connected across limiter cathode choke L1, with the minus (—) terminal of the meter connected to ground.

24. Signal Tracing Using an F-M Signal Generator

a. GENERAL. (1) At the beginning of the test, turn all switches to OFF, and release all push buttons.

Caution: Do not remove the shield can of a tuned unit until the trouble has been traced to that particular unit. Do not push the wiring back and forth during inspection, as this may damage it.

(2) Place a good dynamotor of the correct voltage rating, for the battery available, in the set before the test.

(3) Except as otherwise noted, ground one side of the signal generator and connect the other side to the receiver being tested.

(4) Note the volume, and listen for serious distortion from the loudspeaker at the various points in the signal tracing procedure. If possible, compare with a good receiver.

(5) Check the wiring and soldering in each stage. If repairs are necessary, complete them before proceeding.

(6) Misalignment of one or more stages of the receiver will cause reduced output. Misalignment of the radio-frequency oscillator may, however, prevent any output.

(7) In this outline, no signal or no beat note means either no signal from the loudspeaker, a signal that is weaker than it should be, or a seriously distorted signal.

(8) When trouble is localized in a given stage, first test the tube (if such a test is indicated in the procedure), then the voltage, and finally the resistance at the tube socket of that stage. For values see voltage and resistance diagram (fig. 24) and individual stage diagram (figs. 26 through 37).

(9) Trouble in a circuit or a stage may not show in voltage and resistance measurements at the tube socket. Hints included in this section are merely a guide and should suggest other procedure, such as voltage and resistance measurements on individual parts.

(10) Remove only one tube at a time when testing. Check the number of the tube, test it, and return it to its proper socket before another tube is removed.

(11) It frequently helps to connect (with a clip lead) terminal 5 of tube V3 to the negative side of capacitor C25 (to which blue tracer leads are attached) when performing the audio- and intermediate-frequency tests outlined in paragraph 19*b* and *c*. This stops the radio-frequency oscillator and reduces interference. Be sure to remove this clip lead before proceeding with the radio-frequency tests.

(12) After the previous steps have been satisfactorily completed isolate and clear any trouble located before proceeding with the next step.

(13) When all sources of trouble have been

found, check the receiver to see that it satisfies the over-all test requirements. (See sec. VI.)

b. Audio-frequency Tests. See table I for characteristics of the audio signal generator required.

(1) *Secondary of T1 (speaker circuit).* Throw the SPEAKER switch to ON, and connect an audio signal through a series capacitor to the blue-brown tracer (fifth terminal counting from the front panel) on output transformer T1. Listen for noise output in the speaker. Notice that it is not necessary to remove the front panel in order to gain access to the terminals of transformer T1. The volume of noise will be very low. If no output is heard, check the circuit elements such as SPEAKER switch D3, the output transformer, the loudspeaker, etc.

Note. In replacing the front panel (if it has been removed) be sure that the wires are all pushed down beside potentiometers P1 and P2 and preferably tied in place.

(2) *Secondary of T1 (phones circuit).* Throw the RADIO & INT-INT ONLY switch to RADIO & INT, and connect the signal to the blue-green tracer on output transformer T1 (third terminal counting from the front panel). Try the headset in both PHONES jacks. Noise should be heard when the headset is plugged into either jack. If no signal is heard, remove the front panel and test (by resistance measurements if possible) such items as resistors R22, R23, and R33, switch D2, the jacks, and terminals 12, and 14 of PG3 and J3. Jacks and headsets may be at fault, or a permanent ground may exist on the receiver disabling lead.

(3) *Primary Circuit of T1.* Place the audio signal on the blue-yellow tracer (second terminal counting from the front panel) on the output transformer T1 and listen for the signal from the speaker or headset. If no signal is present, C33 may be shorted or terminals 16 and 17 of plug PG3 may not be making good contact.

(4) *Terminal 5 of Tube V8 (grid of second audio amplifier).* Turn the receiver on. Put the signal on terminal 5 of tube V8. Listen for output in the speaker. If there is no output, test the tube and the voltages at the socket terminals. (See fig. 25.) C21, R19, or R18 may be faulty. Check continuity to terminals 5, 6, and 10 of PG3 or J3.

(5) *Terminal 2 of Tube V10 (plate of first audio amplifier).* Introduce the signal at terminal 2 of V10 and listen for a signal from the loudspeaker. If there is no signal, R18, C10, or C21 may be at fault. Check terminals 5, 6, and 10 of PH3 or J3 for continuity.

(6) *Terminal 1 of Tube V10 (grid of first audio amplifier).* Put the signal on terminal 1 of tube V10. Reduce the signal input. If there is no signal from the loudspeaker, test the tube. Circuit elements such as C11, C12, C13, C26, or R10 may be faulty. Note that when the SQUELCH switch is at OFF it should connect ground to R12 (the side away from the tube).

(7) *Terminal 5 of Tube V10 (plate of I-F oscillator).* Place the signal on terminal 5 of tube V10. Throw the TUNE-OPERATE switch to OPERATE. If there is no signal from the loudspeaker, R6, C10, or D5 may be faulty.

(8) *Junction of Capacitor C11 and Resistor R10.* Put the signal at the junction of C11 and R10. If the signal is not heard from the speaker, R10, or C11 may be faulty.

(9) *Terminal 4 of Tube V7 (output of discriminator).* Place the signal across the output resistance (R81 in series with R83) of the discriminator (terminal 4 of V7). If there is no signal in the loudspeaker, check circuit elements such as V7, C81, C82, R81, R82, R83, or R84.

c. Intermediate-frequency Tests. For reference to intermediate-frequency test signal sources, see table I.

(1) *Terminal 7 of Tube V6 (plate of limiter).* With the intermediate-frequency signal applied through a series capacitor to the plate of the limiter (terminal 8 of V6), place the SQUELCH switch at OFF, the TUNE-OPERATE switch at TUNE, and listen for a beat note from the loudspeaker. If this beat note is not heard, note the setting and then vary the slug adjustment in LCU4 to obtain a beat note. If the beat note cannot be obtained, such circuit elements as C10, LCU4, FL4, or D5 may be faulty. Retune the slug in LCU4 for a beat note with the intermediate-frequency source after the trouble has been cleared.

(2) *Terminal 4 of Tube V6 (grid of limiter).* Put the signal on terminal 4 of tube V6. If there is no beat note from the speaker, with the TUNE-OPERATE switch at TUNE, test tube V6 and other circuit elements. Voltage and resistance measurements at the tube socket terminals (fig. 25) may be useful.

(3) *Terminal 8 of Tube V5 (plate of second I-F amplifier).* With the signal on terminal 8 of tube V5 repeat the procedure given for the preced-

ing stage. If there is no signal, FL3 may be misaligned or faulty. If the alignment is not at fault, test such elements as V5, R13, C14, C15, or C7. If the alignment has been altered, realign FL3 after the trouble has been corrected.

(4) *Terminal 4 of Tube V5 (grid of second I-F amplifier)*. Place the signal on terminal 4 of Tube V5. Repeat the procedure which was given for the limiter stage. If the test of the tube is satisfactory, there may be trouble in circuit elements such as FL7, C7, or R8.

(5) *Terminal 8 of Tube V4 (plate of first I-F amplifier)*. Feed the signal to terminal 8 of V4. If no beat note is obtained from the speaker, test the tube. FL7 may be misaligned or faulty.

(6) *Terminal 4 of Tube V4 (grid of first I-F amplifier)*. Introduce a signal on terminal 4 of tube V4. If no beat note is obtained and the tube is satisfactory, the trouble may be in FL7, C6, or associated circuit elements.

(7) *Terminal 8 of Tube V2 (plate of modulator)*. With the signal on terminal 8 of tube V2, listen for a beat note from the loudspeaker. If none is obtained, test the tube and make voltage and resistance measurements (fig. 25); FL1 may be misaligned or faulty. Check the associated circuit elements.

(8) *Terminal 4 of Tube V2 (grid of modulator)*. Place the signal on terminal 4 of tube V2. If a beat note is not obtained, test the tube. The trouble may be in LCU2. Check for a short circuit of C1.5 or C1.6.

(9) *Terminal 4 of Tube V2 (discriminator test)*. With the intermediate-frequency signal still on the grid of the modulator (terminal 4 of tube V2), measure the voltage across the series combination of R81 and R83 (between terminals 4 and 8 of tube V7, or between terminals 3 and 7 of FL4). Turn off the intermediate-frequency oscillator by setting the TUNE-OPERATE switch at OPERATE. Align the secondary of FL4 to obtain a zero reading on the voltmeter. As the alignment is varied either way from this point, the reading of the voltmeter should change polarity. In order to test the primary of FL4, connect the meter between terminals 3 and 8 of FL4. Adjust the primary slug of FL4 for maximum reading on the voltmeter. This is not an alignment but merely a check on the alignment capability of this circuit. Leave the circuit in approximate alignment after clearing any trouble that may have been present in FL4 or associated circuits. If a signal generator having a 1.0-volt output at 2.65 mc is used, the signal generator may be applied to the grid of the limiter (terminal 4 of tube V6) rather than to terminal 4 of tube V2; the procedure in this test is otherwsie the same.

d. Radio-frequency Tests. For reference to radio-frequency test signal sources see table I.

(1) *Terminal 4 of Tube V2 (grid of modulator)*. Apply a radio-frequency signal through a capacitor to the grid of the modulator (terminal 4 of tube V2). Set the TUNE-OPERATE switch to TUNE. Manually set the dial of the trouble receiver to approximately the frequency of the radio-frequency source and tune for a beat note. If it is impossible to obtain a beat note, either the source of radio frequency is not providing voltage on the grid of tube V2 or the radio-frequency oscillator of the trouble receiver is not functioning. In the latter case check V3, LCU2, R4, R5, C5, and associated circuit elements. C1.7 and C1.8 may be shorted. Make resistance and voltage measurements at the tube socket terminals. (See fig. 25.) In order to isolate the trouble in the oscillator stage, put the radio-frequency signal on the suppressor grid of the modulator (terminal 3 of V2). If the characteristic no-signal rushing noise is heard from the loudspeaker with the test signal, but is not heard when the test signal is absent, then the oscillator stage is faulty. However, if the oscillator stage is operating but is not properly aligned, the rushing noise may be present, but a weak beat note may appear more than one channel away from the proper setting. A realignment of the oscillator is indicated.

Caution: Any attempt to vary the adjustment of the slug in LCU3 or LCU3B will result in a change in the tracking of the oscillator stage. This stage will probably then require careful alignment. This procedure is described in paragraph 19*c*. No adjustment of LCU3, (or LCU3B) and C1.7 should be attempted until the method is fully understood.

(2) *Terminal 8 of Tube V1 (plate of R-F amplifier)*. Place the signal on terminal 8 of tube V1. If no beat note is heard in the speaker, test tube V1. It may be that LCU2, C1.3, or C1.4 are shorted. Make voltage and resistance measurements.

(3) *Terminal 4 of Tube V1 (grid of R-F amplifier)*. Place the signal on terminal 4 of tube V1 and listen for the beat note. If no beat note can be obtained and the tube is not at fault, check LCU1, C1.1, and C1.2 for short circuits. LCU2 may be misaligned.

(4) *Antenna post.* Put the signal on the A (antenna) post. If there is no beat note, LCU1 may be misaligned or faulty. Test the antenna connections to LCU1.

(5) *Squelch circuit and sensitivity control.* (*a*) Turn the SQUELCH switch to ON and adjust the SENSITIVITY control for maximum sensitivity (full right rotation). The CALL SIGNAL lamp should light when the signal is tuned in. If it does not go out when the signal is tuned out, turn the SENSITIVITY control to the left to reduce the sensitivity until it does. The noise from the loudspeaker should cease whenever the CALL SIGNAL lamp is extinguished. When the signal is tuned in again, the lamp should light.

(*b*) Reduce the signal, as instructed above, just short of the frequency where the CALL SIGNAL lamp would go out. Turn the SENSITIVITY control to the left, and the lamp should go out.

(*c*) If operation of the squelch circuit and sensitivity control is not normal, test V9. Circuit elements such as R15, R16, R17, C17, C18, C20.2, C12, R21, R24, R25, R26, R27, R28, R29, R31, R95, or R96 may be faulty.

(6) *Tuning.* When all troubles have been removed, the tuning for all channels should be checked. If an LCU or an FL unit has been repaired or replaced, or if its adjustment has been changed, that unit should be realigned. If several units have been changed, or there is any question of alignment, the whole receiver should be realigned.

e Short Cuts (fig. 44). Signal tracing procedure may be simplified by determining at the outset, whether the trouble is in the audio-, intermediate-, or radio-frequency circuits. This may be determined in the following order:

(1) *Audio-frequency circuits.* Put an audio-frequency signal on the output of the discriminator (terminal 4 of V7). If the output from the speaker is missing or weak, the trouble is probably located in the audio-frequency circuit.

Caution: An inexperienced repairman may fail to recognize a loss of amplification in the set in these tests. Be sure to make a comparison with a good receiver.

(2) *Intermediate-frequency circuits.* Put an intermediate-frequency signal on the grid of the modulator (terminal 4 of V2). When the TUNE-OPERATE switch is at TUNE, a beat note should be heard. If step (1) above gave a beat note but none is heard now, the trouble is probably in the intermediate-frequency part of the circuit.

(3) *Radio-frequency circuits.* Place a radio-frequency signal on the A (antenna) post. Tune the receiver to the frequency of the test signal. Throw the SQUELCH switch to ON. The squelch circuits should operate satisfactorily with the SENSITIVITY control near its minimum or extreme left position. Throw the SQUELCH switch to OFF; a beat note should be heard from the speaker. The tuning dial setting should agree approximately with the test signal frequency. Test the squelch and sensitivity control operation as described in *d*(5) above.

25. Signal Tracing Using a Good Receiver

If no f-m signal generator is available, a second receiver may be used for signal tracing. Keep it in good operating condition at all times to use as a source of test signals. The audio-, intermediate-, and radio-frequency signals may be obtained from appropriate points in the good receiver, as follows:

a. Audio-Frequency. Audio-frequency signals may be obtained from one of the PHONES jacks of the good receiver. The VOLUME control of this receiver may be adjusted to give a satisfactory level of no-signal noise for use in testing the audio stages of the trouble receiver. If the signal strength is too great, the audio stages of the trouble receiver may be overloaded, thereby giving deceptive results. Connect the *tip* of a plug to a capacitor of 0.001-mf or greater capacitance. Insert the plug into one of the PHONES jacks to obtain an audio-frequency source. Connect the chassis of the two receivers together to complete the circuit. Throw the RADIO & INT-INT ONLY switch to RADIO & INT.

b. Intermediate Frequency. With the TUNE-OPERATE switch at TUNE, intermediate frequencies can be obtained from the good receiver at terminal 7 of FL4. A somewhat higher output is available at terminal 2 of FL4; use the former (lower level) point for all cases except where the circuits are badly misaligned. In all cases make the connection through a capacitor (preferably 0.001-mf or larger) located close to the source of test tone. If you have no capacitor, twist two insulated wires for about 18 inches, making sure that there is no metallic connection between the wires. These two wires (at the far end) form the two ends of the lead which carries the test frequencies. In order to prevent unwanted pick-up combine this lead (in a twisted pair) with the ground wire which forms

the circuit return. Mark each wire so it may be identified. Equip each wire of the pair with clips, and run it directly from the signal source to the point of use, preferably under the bottom of the good receiver (if it is at the left side). Leave the untwisted part as short as possible. This twisted pair for pick-up and test frequency will then consist of:

(1) An insulated wire about 3 feet long used for connecting the chassis of the trouble receiver to the chassis of the source.

(2) Another insulated wire about 4 feet long cut in the middle, and with the 2 ends connected through a capacitor, or wrapped together for about 18 inches where they overlap.

c. Radio Frequency. The radio frequency may be obtained from the good receiver at the suppressor grid of the modulator (terminal 3 of V2). For most alignment purposes, the stray pick-up between two receivers placed about 2 feet apart is sufficient. For signal tracing, more pick-up may be necessary. In this event, connection may be made by using a capacitor or two wires twisted together as described in *b* above. This frequency will be about 2.65 mc above the frequency indicated by the dial. Therefore, tune the receiver being tested to a frequency which is approximately 2.65 mc above that to which the good receiver is tuned.

26. Signal Tracing Using a Good Transmitter

A transmitter in good condition may be used as a source of signals in the audio- or radio-frequency stages of a trouble receiver, if neither an f-m signal generator nor a good receiver is available.

a. Audio Frequency. If the transmitter is in a mounting, an audio-frequency tone can be obtained from terminal 1 of terminal strip TS401. This terminal is visible in the case of the mounting when the door in the mounting at the left receiver position is opened.

Caution: Use a 0.001 to 1.0 mf capacitor in series with the lead, as one side of the audio source is grounded.

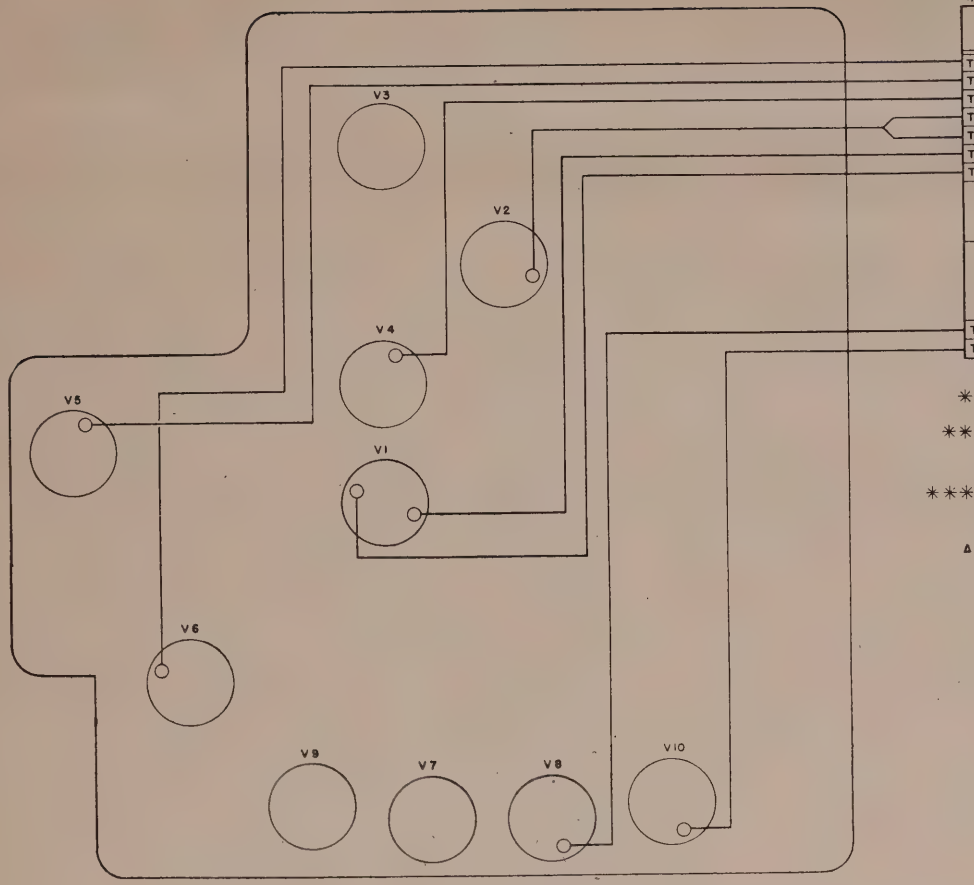
If the receiver is placed in Mounting FT–237–(*) with the transmitter, throw the RADIO & INT-INT ONLY switch to INT ONLY. Turn the transmitter on. Audio frequencies will be available if the operator presses the microphone button of the transmitter and whistles or hums into the microphone. A throat microphone may be used.

b. Intermediate Frequency. Since no source of 2.65 mc is available in the transmitter, no direct method of signal tracing in the intermediate-frequency section is available with the transmitter.

c. Radio Frequency. In general, no direct connection between transmitter and receiver is necessary for picking up test radio frequencies for alignment work. In signal tracing, where direct connection may be needed, use a shielded wire, with one end connected to the antenna terminal of the receiver, and the other hung near the transmitter. Connect a capacitor in series with this wire to prevent accidental short circuits.

27. Signal Tracing Using an A-M Signal Generator

Since signal tracing as outlined here requires the use of a frequency-modulated signal, an a-m signal generator is not suitable. The signal may be traced through the set to the discriminator circuit by the use of oscilloscopes, etc., but no provision is made here for the use of such instruments. If the a-m signal generator has an independent audio output it may be used for signal tracing in the audio stages in the same fashion as the audio output of the f-m signal generator.



SIGNAL TEST POINTS	TEST FREQUENCY (MC)	* INPUT REQUIRED FOR CORRECT CATHODE METER READING	** OUTPUT METER READING
TERMINAL 4 OF V6 & CHASSIS	2.65	1 VOLT	16 VOLTS (APPROX.) 400 CPS
TERMINAL 4 OF V5 & CHASSIS	2.65	0.05 VOLT (APPROX.)	16 VOLTS (APPROX.) 400 CPS
TERMINAL 4 OF V4 & CHASSIS	2.65	1500 MICROVOLTS (APPROX.)	16 VOLTS (APPROX.) 400 CPS
TERMINAL 4 OF V2 & CHASSIS	2.65	50 MICROVOLTS (MAX.)	16 VOLTS (APPROX.) 400 CPS
TERMINAL 4 OF V2 & CHASSIS	28.0	300 MICROVOLTS (APPROX.)	16 VOLTS (APPROX.) 400 CPS
TERMINAL 8 OF V1 & CHASSIS	28.0	100 MICROVOLTS (APPROX.)	16 VOLTS (APPROX.) 400 CPS
TERMINAL 4 OF V1 & CHASSIS	28.0	1.5 MICROVOLTS (APPROX.)	16 VOLTS (APPROX.) 400 CPS
ANTENNA & GROUND TERMINALS	20.0	1.0 MICROVOLT (MAX.) REQUIRED TO OPERATE SQUELCH	
ANTENNA & GROUND TERMINALS	28.0	1.0 MICROVOLT	11 VOLTS (APPROX.) 150 CPS 20 VOLTS (APPROX.) 400 CPS 20 VOLTS (APPROX.) 1000 CPS 11 VOLTS (APPROX.) 2500 CPS 4 VOLTS (APPROX.) 5000 CPS
TERMINAL 5 OF V8 & CHASSIS	1000 CPS Δ	1 VOLT	2 VOLTS (APPROX.) 1000 CPS
TERMINAL 1 OF V10 & CHASSIS	1000 CPS Δ	1 VOLT	18 VOLTS (APPROX.) 1000 CPS

* THE SIGNAL GENERATOR CONNECTION SHALL ALWAYS BE MADE THROUGH A 0.006 MF SERIES CAPACITOR.

** CORRECT CATHODE METER READING CAN BE OBTAINED BY APPLYING 2.65 MC AT 1 VOLT BETWEEN TERMINAL 4 OF V6 AND CHASSIS. THIS METER READING SHOULD FALL BETWEEN LIMITS OF 0.6 VDC AND 0.9 VDC AS READ ON THE V.T.V.M. AND SHOULD BE MAINTAINED AT THIS VALUE WHILE TRACING THE SIGNAL BY ADJUSTMENT OF THE OUTPUT OF THE SIGNAL GENERATOR.

*** SQUELCH SWITCH OFF AND VOLUME CONTROL IN MAXIMUM CLOCKWISE POSITION. A FREQUENCY MODULATED SIGNAL GENERATOR (±15 KC DEVIATION) IS REQUIRED FOR OUTPUT MEASUREMENTS INVOLVING RF AND IF INPUTS. SPEAKER SWITCH SHOULD BE IN OFF POSITION WHEN MEASUREMENTS ARE MADE.

Δ THIS MEASUREMENT IS TO BE MADE IF AN AUDIO FREQUENCY SOURCE IS AVAILABLE.

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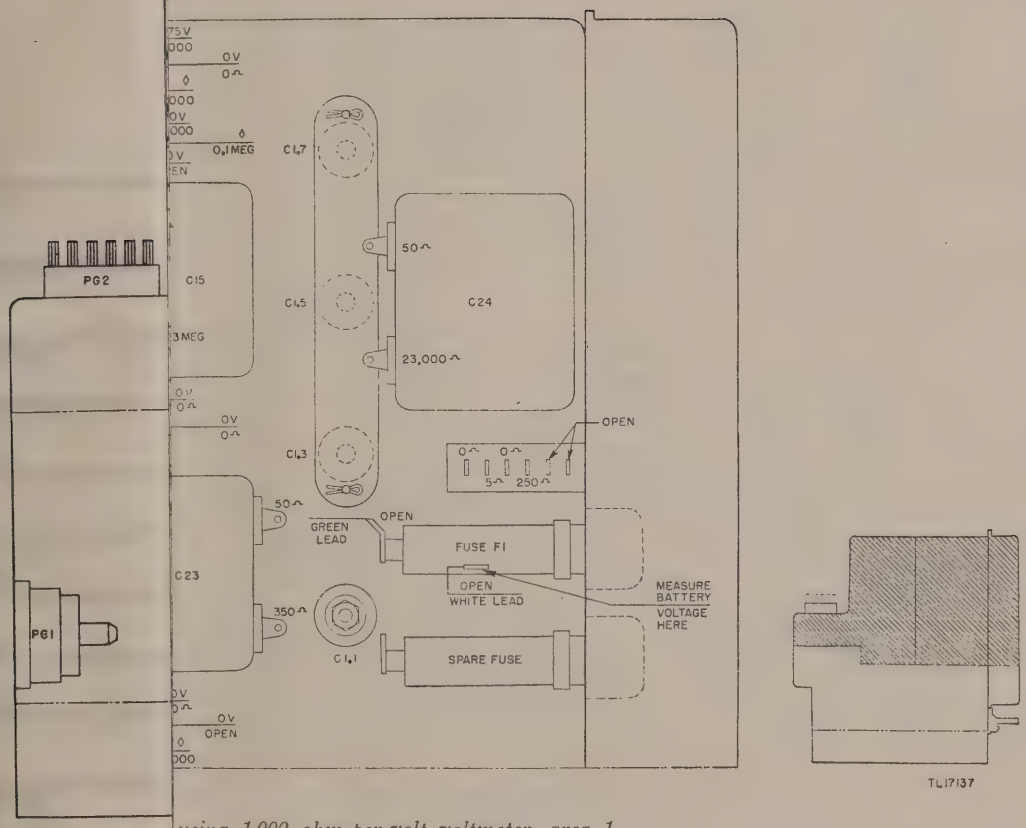
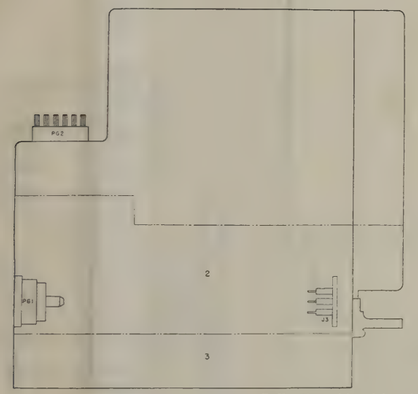
Figure 23. Radio Receiver BC–603–(*), signal tracing chart.



using 1,000 ohm-per-volt voltmeter, area 1.



① *Key plan and legend for voltage and resistance diagram.*

AREA	FIGURE NUMBER 603(*)	
	V.T.V.M.	1000 OHMS PER VOLT
1	24 b	24 c
2	24 d	24 e
3	24 d	24 c
P61	24 d	24 e
P62	24 b	24 c
J3	24 d	24 c

VOLTAGE MEASUREMENTS

NOTES:

1. ALL VOLTAGES SHOULD BE MEASURED BETWEEN THE DESIGNATED TERMINAL AND THE RECEIVER CHASSIS.
2. ALL SWITCHES EXCEPT THE TUNE-OPERATE AND THE ON-OFF SHOULD BE IN THE DOWNWARD POSITION.
3. VOLTAGES GIVEN ARE AVERAGE READINGS. A RECEIVER WHICH IS OPERATING SATISFACTORILY NEED NOT BE SERVICED JUST BECAUSE CERTAIN READINGS DIFFER FROM THOSE GIVEN AS DIFFERENCES IN MANUFACTURED EQUIPMENT CAUSE VARIATIONS IN VOLTAGES.
4. FIGURES GIVEN ARE BASED ON 12 OR 24 VOLTS FROM THE BATTERY. FOR OTHER BATTERY VOLTAGES THE READINGS GIVEN SHOULD BE ADJUSTED IN PROPORTION.
5. ACCURACY REQUIRES THAT ON MEASUREMENTS WITH A METER OF 1000 OHMS PER VOLT, THE FULL-SCALE READING OF THE METER MUST BE HIGHER THAN THE EXPECTED VOLTAGE.
6. VACUUM TUBE VOLTMETER MEASUREMENTS ARE BASED ON A VOLT-OHMMETER I-107 OR EQUIVALENT.
7. ⊕ MEANS NOT TO EXCEED 0.5 VOLTS ON METER OF 1000 OHMS PER VOLT.
8. FILAMENT VOLTAGES ARE SHOWN AS TWO VOLTAGES SEPARATED BY THE WORD "OR". THE FIRST READING IS FOR A 12-VOLT BATTERY; THE SECOND READING IS FOR A 24-VOLT BATTERY.

RESISTANCE MEASUREMENTS

NOTES:

1. ALL RESISTANCE VALUES SHOWN ARE MEASURED BETWEEN THE RECEIVER CHASSIS AND DESIGNATED TERMINAL POINT.
2. A VARIATION OF ±20% FROM THE INDICATED VALUES SHOULD NOT BE REGARDED AS AN INDICATION OF A DEFECTIVE RECEIVER.
3. CERTAIN DISCREPANCIES MAY BE OBSERVED BETWEEN THE SCHEMATIC DRAWING CONTAINED IN THESE INSTRUCTIONS AND THE CIRCUIT LABEL APPEARING ON THE RECEIVER. THESE DISCREPANCIES ARE DUE TO CHANGES MADE IN MANUFACTURE, IN SUCH CASES THE CIRCUIT LABEL APPLIES. NATURALLY, SUCH DISCREPANCIES MAY AFFECT THE RESISTANCE VALUES INDICATED.
4. THE DYNAMOTOR MUST BE REMOVED BEFORE MAKING ANY RESISTANCE MEASUREMENTS.
5. PLACE ALL SWITCHES IN THE "OFF" OR DOWNWARD POSITION EXCEPT THE TUNE-OPERATE AND THE RADIO AND INT-C-MT, ONLY (OR OUTPUT TO PHONES) SWITCH WHICH SHOULD POINT UP.
6. TURN THE VOLUME AND SENSITIVITY CONTROLS TO THEIR MAXIMUM CLOCKWISE POTATION.
7. TO CHECK THE VOLUME CONTROL, CONNECT THE OHMMETER TEST LEAD TO TERMINAL 8 OF J3. WITH THE VOLUME CONTROL AT MAXIMUM THE MEASURED RESISTANCE SHOULD BE APPROX. 100,000 OHMS AND SHOULD DECREASE TO 50 OHMS AS THE VOLUME CONTROL IS TURNED TO ITS EXTREME COUNTERCLOCKWISE POSITION.
8. TO CHECK THE SENSITIVITY CONTROL, MEASURE THE RESISTANCE FROM THE TERMINAL OF C25 TO WHICH THE BLUE LEADS ARE ATTACHED. THE RESISTANCE AT THIS POINT SHOULD VARY BETWEEN 50 AND 250 OHMS AS THE SENSITIVITY CONTROL IS ROTATED, WHEN THIS CHECK IS MADE THE SQUELCH SWITCH MUST BE IN THE "ON" POSITION. ALL OTHER CHECKS ARE MADE WITH THIS SWITCH OFF.

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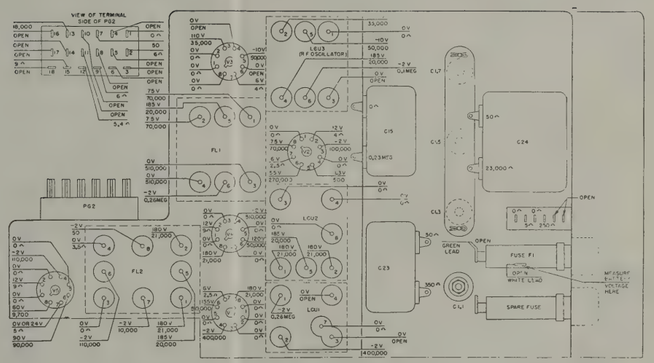

⑤ *Voltage and resistance diagram using vacuum-tube voltmeter, area 1.*

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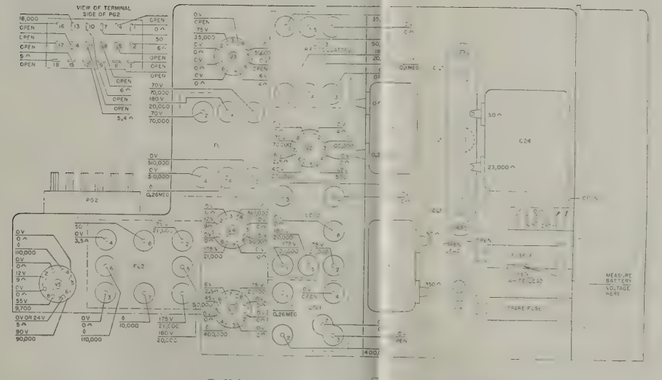
Figure 24. Radio Receiver BC-603-(*).



③ *Voltage and resistance diagram using 1,000 ohm-per-volt voltmeter, area 1.*

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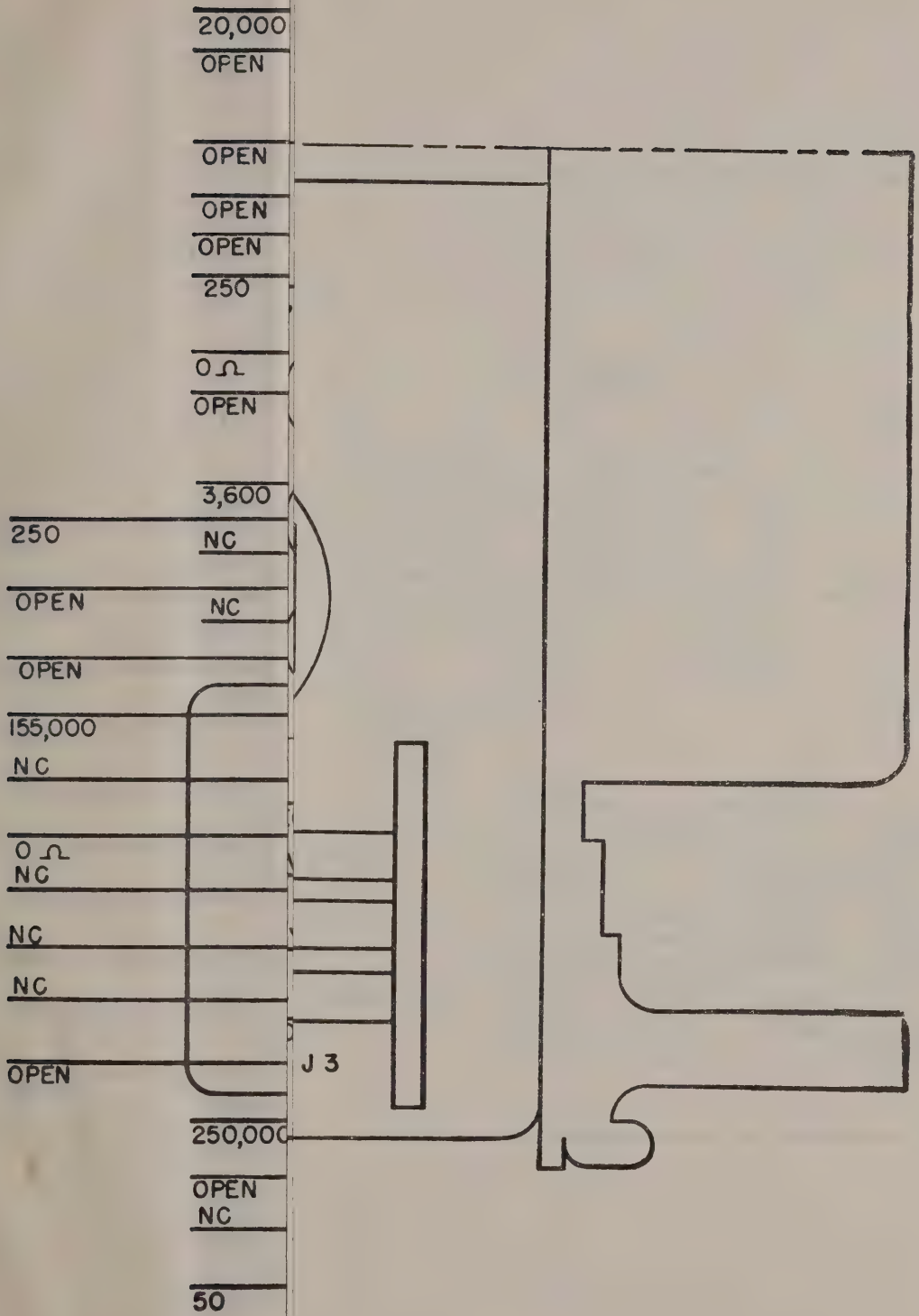
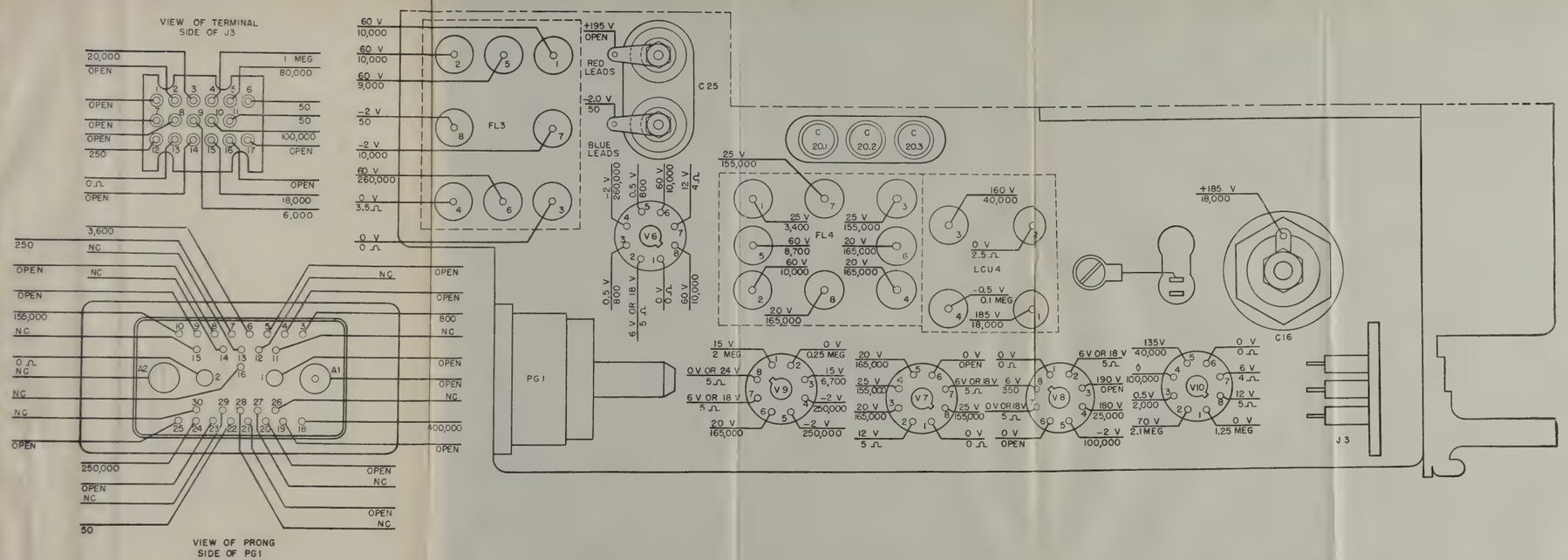
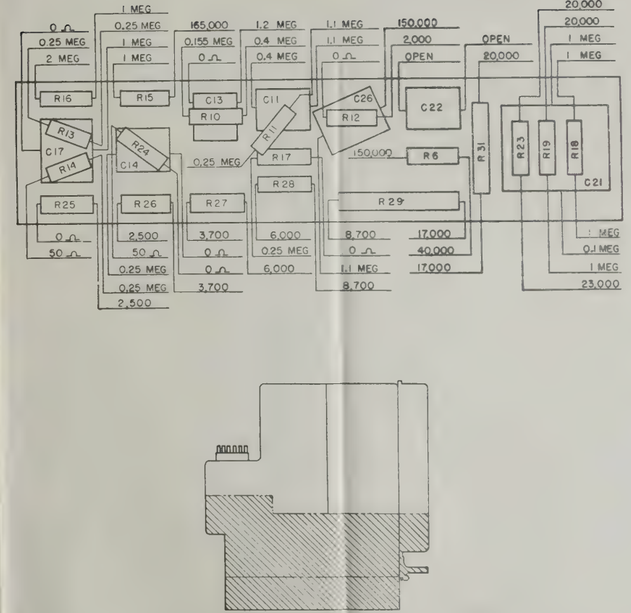
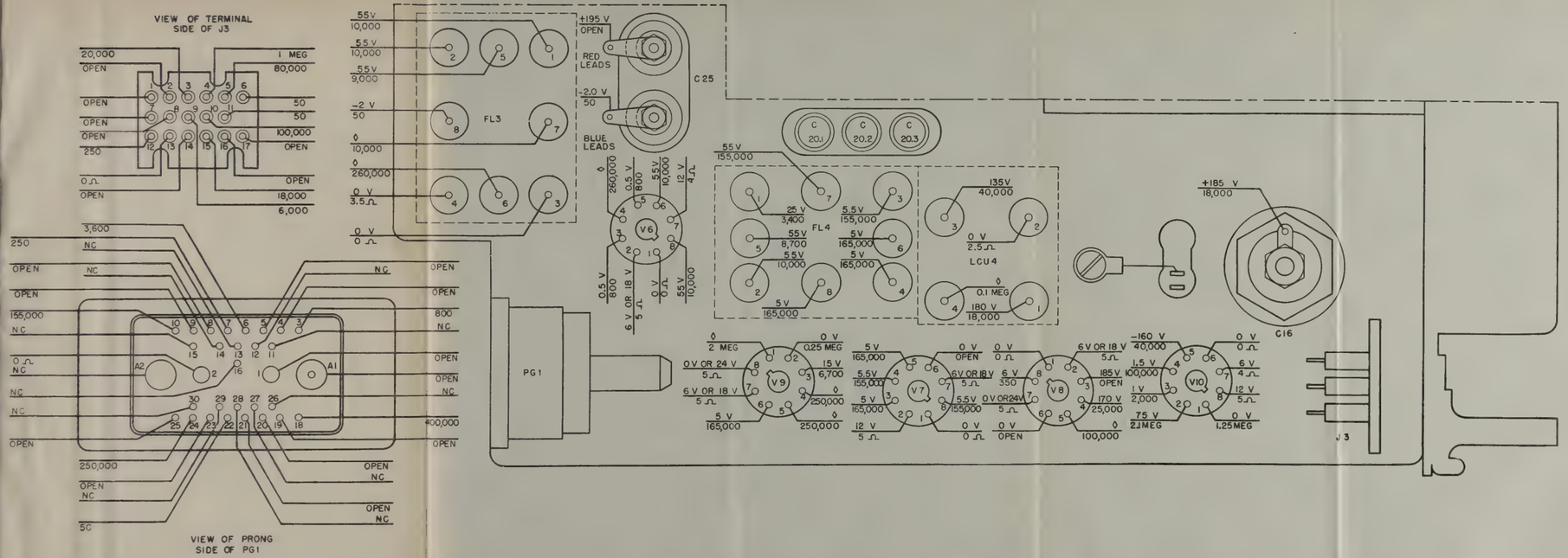

20,000
OPEN
OPEN
OPEN
OPEN
250
0 Ω
OPEN
3,600
250
NC
OPEN
NC
OPEN
155,000
NC
0 Ω
NC
NC
NC
OPEN
J 3
250,000
OPEN
NC
50



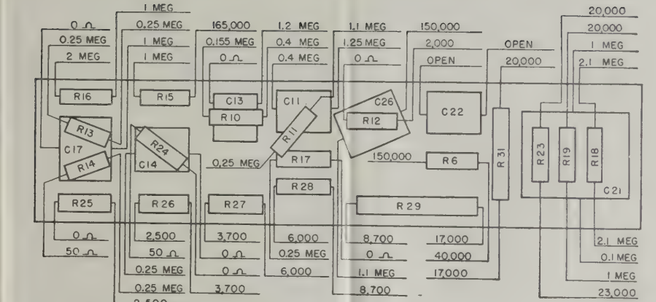
④ *Voltage and resistance diagram using vacuum-tube voltmeter, areas 1 and 3.*
Figure 24—Continued.

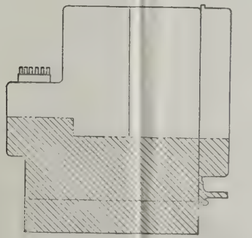




© *Voltage and resistance diagram using 1,000 ohm-per-volt voltmeter, areas 2 and 3.*

Figure 24—Continued.





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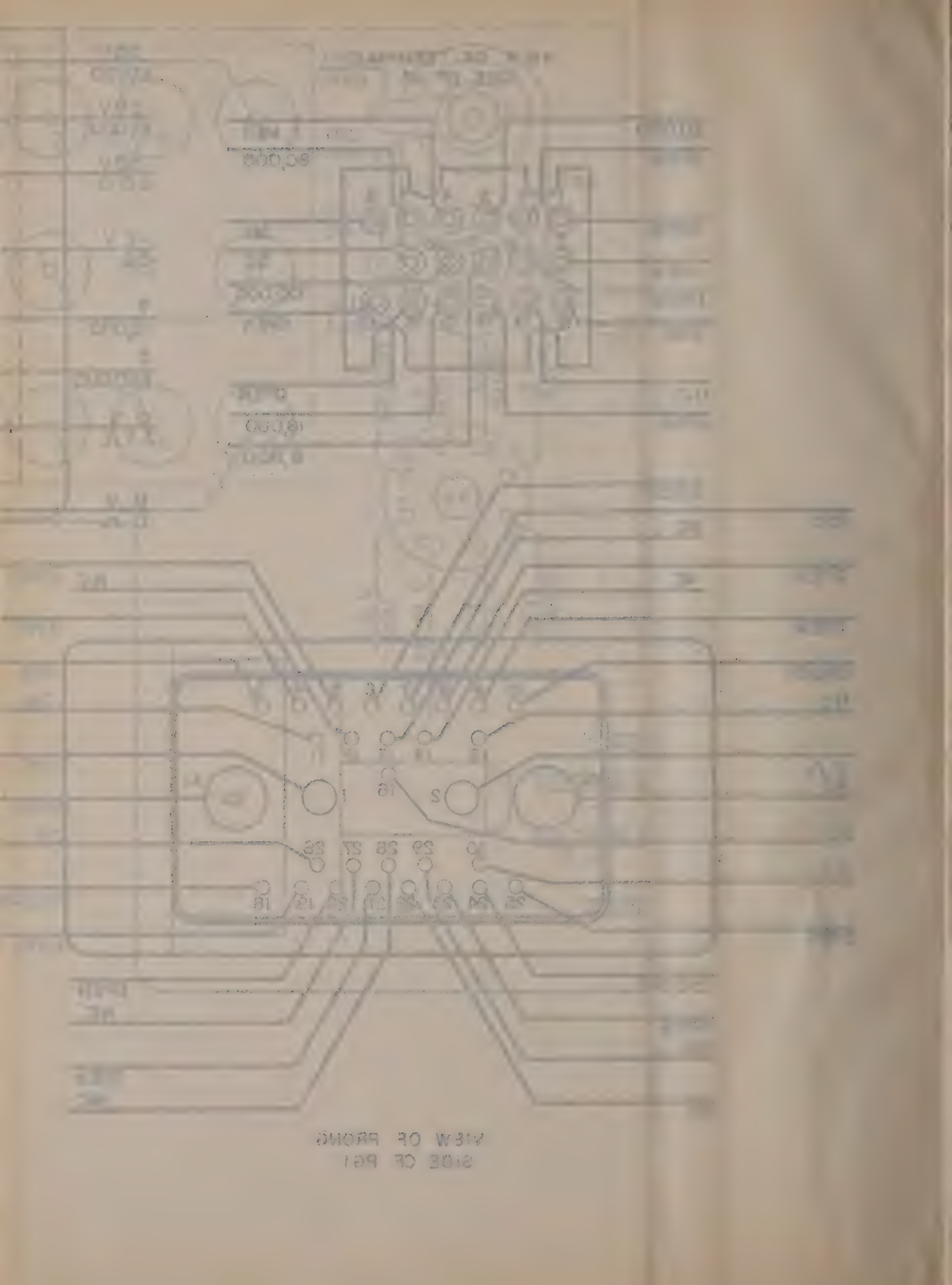


SECTION VII

FINAL TESTING

28. Over-all Test Requirements

After the procedures of section V have been completed, the following tests must be performed.

a. Check of Circuit Alignment. (1) Remove the receiver dust cover and connect the receiver to an appropriate power source.

(2) Turn the SPEAKER switch to ON, the TUNE-OPERATE switch to TUNE, and the SQUELCH switch to ON. Turn the SENSITIVITY and VOLUME controls to the extreme right. Turn the receiver ON.

(3) Set the signal generator at 24 mc. Connect the signal generator to posts A and G of the receiver. Manually tune the receiver to zero beat. Make sure that the CALL SIGNAL lamp lights. Read the setting of the receiver dial.

(4) Carefully adjust the tuning dial to each side of the zero-beat setting until the CALL SIGNAL lamp goes out. Note the two dial readings at the points where the lamp goes out. The lamp should remain lighted over approximately three channel divisions, and the zero-beat setting should be close to the center of this range.

(5) Set the SENSITIVITY control at the extreme left (minimum sensitivity), and carefully adjust the tuning dial to each side of the zero-beat setting. The lamp should remain lighted over approximately two channel divisions, and the zero-beat setting should be at the center of the tuning range.

(6) Repeat steps (3) through (5) above, setting the signal generator at 28 mc.

(7) Repeat steps (3) through (5) above, setting the signal generator at 20 mc.

(8) If the zero-beat setting in step (5) above is not centered, the receiver requires realignment.

b. Check of Sensitivity and Stability. (1) Set the f-m signal generator at 28 mc and adjust the receiver to zero beat at 28 mc. Connect the signal generator to posts A and G of the receiver. Then reduce the signal generator output to zero.

(2) Switch the SQUELCH control to ON and adjust the SENSITIVITY control so that the CALL SIGNAL lamp is barely extinguished.

(3) Increase the generator output sufficiently to illuminate the CALL SIGNAL lamp. A signal of 1.0 μv or less should be sufficient.

(4) Repeat steps (2) and (3) above at 20 mc.

(5) Set the signal generator to give a 3-μv output at 28 mc. It should be possible to extinguish the CALL SIGNAL lamp by turning the SENSITIVITY control to the left. Repeat this test at 20 mc.

(6) Throw the TUNE-OPERATE switch to TUNE and adjust the tuning dial for a low-pitched beat note.

(7) Vary the signal-generator output from about 1.0 to 1000 microvolts. The pitch of the beat note should remain within audibility over the entire range of signal voltage.

c. Check of Output Power. (1) Adjust the signal-generator frequency to 20 megacycles and 1.0-microvolt output.

(2) With the SPEAKER switch at ON, and the TUNE-OPERATE switch at TUNE, set the RADIO & INT—INT ONLY switch at RADIO & INT. Set the SQUELCH switch to ON. Turn the SENSITIVITY and VOLUME controls to the extreme right.

(3) Tune to zero beat with the signal generator and turn the TUNE-OPERATE switch to OPERATE. Turn the SPEAKER switch to OFF.

(4) Modulate the signal generator with 400 cycles, with a frequency deviation of 15 kilocycles, and read the output meter. The meter should read over 18 volts.

d. Noise Test. With the signal-generator output at 1.0 microvolt, remove the modulation from the signal. The output meter should read not more than one-fifth of the reading obtained in *c*(4) above.

e. Check of Limiter Action. (1) With conditions as in paragraph 21*c*, increase the signal gen-

erator output to 10μv and observe the reading of the output meter.

(2) Increase the signal generator output to 100, 1,000, and 10,000 μv successively. The voltmeter reading should stay within ± 5 volts of the reading obtained in step (1) above.

f. VOLUME CONTROL. Remodulate the signal with 400 cycles, with a frequency deviation of 15 kc. Apply a 1.0-μv output to the receiver. Gradually rotate the VOLUME control to the left. The reading of the output meter should decrease progressively to less than 1.0 volt. After restoring the volume to maximum, turn the SPEAKER switch to ON. The output meter reading should remain approximately constant. Observe the tone from the loudspeaker as a check on its operation. A very weak response or a bad rattle indicates that the speaker cone has been damaged.

29. Moistureproofing, Fungiproofing, and Refinishing

a. See TB SIG 13 for general information concerning moistureproofing and fungiproofing.

b. Specific instructions for moistureproofing and fungiproofing of Radio Receiver BC–603–(*) are contained in TM 11–600, including supplement and changes 2.

c. If the receiver case has been scarred or chipped, remove any rough spots with #00 or #000 sandpaper and apply paint to spots with a small brush. If the case is sufficiently scarred and scratched to warrant complete refinishing, remove the receiver chassis from the case, and remove all dirt and rust with kerosene, when necessary. Spray the entire case with the proper paint authorized by existing regulations.

30. Operational Check

The moistureproofing, fungiproofing, and refinishing procedures of section VI may cause the alignment of the receiver to change and may also affect performance characteristics. To determine whether the receiver is operating properly, retest it to make sure it conforms with all the requirements of section VI. Should the receiver not conform with these requirements, it will be necessary to realign it to counteract the effects of the deterioration in performance.

SECTION VIII

INDIVIDUAL STAGE AND CIRCUIT REPAIR DATA

31. General

This section presents information and data for the repair of individual stages and circuits, for the location of parts, and for the replacement of parts requiring special techniques. Schematic diagrams are presented for each stage of Radio Receiver BC–603–(*); each stage schematic is preceded by a parts list, which includes circuit designation, stock number, name, value, and function for each part.

32. Parts List for R-f Amplifier Stage, V1 (fig. 25)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
L32	2C4460	Coil, part of LCU1	Antenna coupling.
Primary of LCU1		Coil, part of LCU1	Antenna coil.
C1.2		Variable air capacitor, 62-mmf, part of push-button tuner assembly.	Tuning control.
C1.1		Trimmer capacitor, 16-mmf, part of push-button tuner assembly.	Trimming.
R37	3Z4562	Resistor, 0.25-meg; ±10%, part of LCU1.	R-f grid filter.
R94	3Z4542	Resistor, 2-meg; ± 10%.	Voltage divider.
C1.4		Variable air capacitor, 62-mmf, part of push-button tuner assembly.	Tuning control.
C13		Trimmer capacitor, 16-mmf, part of push-button tuner assembly.	Trimming.
C36	3D9010–b	Capacitor, 10 ±1-mmf, 500 v dc, part of LCU2.	R-f plate tuning and compensation.
L33	2C4460683A/C2	Coil, part of LCU2	R-f plate tuned.
L34	2C4460683A/C2	Coil, part of LCU2	Coupling; modulator grid tuned coupling.
C38	3D9010–13	Capacitor, 5 ±0.5-mmf, 600 v dc, part of LCU2.	Modulator grid tuning and compensation.
C35	3DA6–1	Capacitor, 0.006-mmf, 300 v dc, part of LCU1.	R-f grid filter.
C2	3DA6–10	Capacitor, 0.0006-mf, 300 v dc.	R-f screen bypass.
R1	3Z4530	Resistor, 20,000-ohm ±10%.	R-f screen filter.
R38	3Z4525	Resistor, 1,000-ohm ±10%, part of LCU2.	R-f plate filter.
C39	3DA5–10	Capacitor, 0.0006-mmf, 300 v dc. part of LCU2.	R-f plate filter.

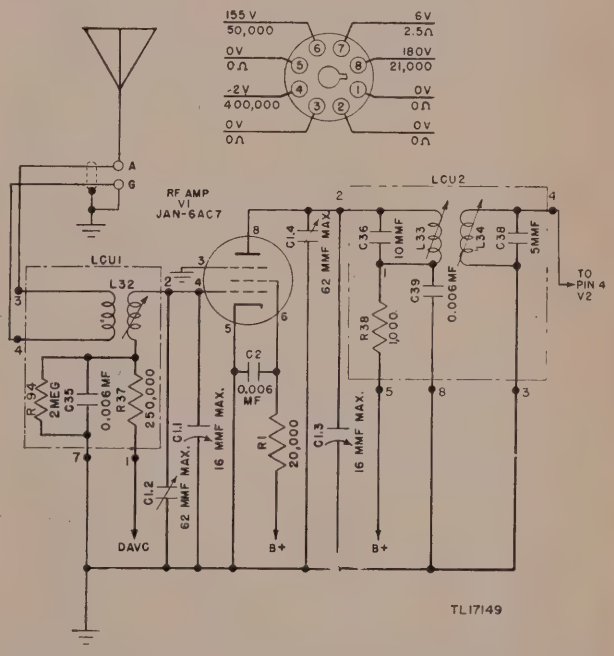


Figure 25. Radio Receiver BC–603–(*), radio frequency amplifier, V1—schematic diagram.

33. Parts List for Modulator Stage, V2 (fig. 26)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C1.6	.....	Variable air capacitor, 62-mmf, part of push-button tuner assembly.	Tuning control.
C1.5	.....	Trimmer capacitor, 16-mmf, part of push-button tuner assembly.	Trimming.
C53	3D9050–13 ..	Capacitor, 50-mmf, 500 v dc, part of FL1.	Modulator plate fixed tuning.
C54	3D9050–13 ..	Capacitor, 50 ±1-mmf, 500 v dc, part of FL1.	Temperature compensator for C53.
L52	3C4403A/C9.	Coil, part of FL1.....	Modulator plate tuned coupling.
L51	2C4403A/C9.	Coil, part of FL1.....	First i-f grid-tuned coupling.
C55	3D9010–5 ...	Capacitor, 10 ±1-mmf, 500 v dc, part of FL1.	Temperature compensator for C56.
C56	3DA6–10 ...	Capacitor, 0.006-mmf, 300 v dc, part of FL1.	First i-f grid fixed tuning.
R52	3Z4540	Resistor, 30,000-ohm ±10%, part of FL1.	First i-f input filter termination.
C51	3DA6–10 ...	Capacitor, 0.006-mmf, 300 v dc, part of FL1.	First i-f grid filter.
R51	3Z4550	Resistor, 0.25 meg-±10%, part of FL1.	First i-f grid filter.
C3	3DA6–10 ...	Capacitor, 0.0006-mf, 300 v dc.	Modulator cathode bias.
R3	3Z4524	Resistor, 500-ohm ±10%.	Modulator cathode bias.
C4	3DA6–10 ...	Capacitor, 0.006-mf, 500 v dc.	Modulator screen bias.
R2	3Z4562	Resistor, 0.25-meg, ±10%.	Modulator screen filter.
R54	3Z4550	Resistor, 0.1-meg, ±10%, part of FL1.	Modulator plate filter.
R53	3Z4550	Resistor, 0.1-meg, ±10%, part of FL1.	Modulator plate filter.

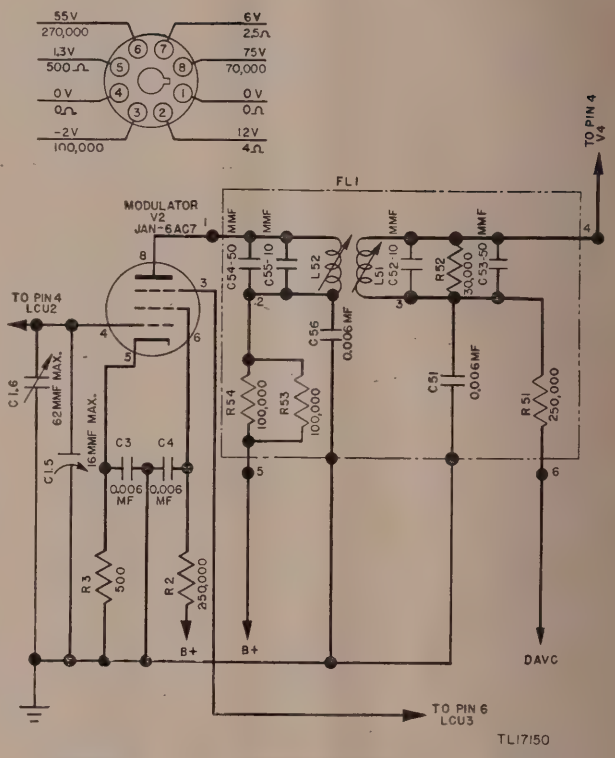


Figure 26. Radio Receiver BC–603–(*), modulator, V2—schematic diagram.

34. Parts List for R-f Oscillator Stage, V3 (fig. 27)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
L41	2C4460–683A/C3	Coil, part of LCU3.....	Beating oscillator tuning and feedback.
C1.8	.....	Variable air capacitor, 62-mmf, part of push-button tuner assembly.	Tuning control.
C1.7	.....	Trimmer capacitor, 16-mmf, part of push-button assembly.	Trimming.
C41	3D9700	Capacitor, 700-mmf, ±5%, 500 v dc, part of LCU3.	Beating oscillator series padder.
C42	3D9200–6 ...	Capacitor, 200 ±10-mmf, 500 v dc, part of LCU3.	Temperature compensation for C41.
C43	3D9100–19A.	Capacitor, 100-mmf, ±5%, 500 v dc, part of LCU3.	Beating oscillator grid blocking.
C44	3D9030–2 ...	Capacitor, 30 ±1.5-mmf, 500 v dc, part of LCU3.	Beating oscillator plate coupling.
C46	3D9020–1 ...	Capacitor, 20 ±1 mmf, 500 v dc, part of LCU3.	Beating oscillator plate temperature compensator.
R4	3Z4531	Resistor, 50,000-ohm ±10%.	Beating oscillator grid leak.
R5	3Z6500–8 ...	Resistor 5,000-ohm ±10%.	Beating oscillator plate filter.
C45	3D9100–19A.	Capacitor, 100-mmf, ±5%, 500 v dc, part of LCU3.	Oscillator modulator coupling.
R41	3Z4550	Resistor, 0.1-meg, ±10%, part of LCU3.	Modulator suppressor grid leak.
C5	3DA6–10 ..	Capacitor, 0.006-mmf, 300 v dc.	Beating oscillator plate filter.
R42	3Z6630–8 ...	Resistor, fixed, 30,000-ohm, ±10%, 1-watt.	Temperature compensation for C41.
R43	3Z6630–8 ...	Resistor, fixed, 30,000-ohm, ±10%, 1-watt.	Beating oscillator grid blocking.

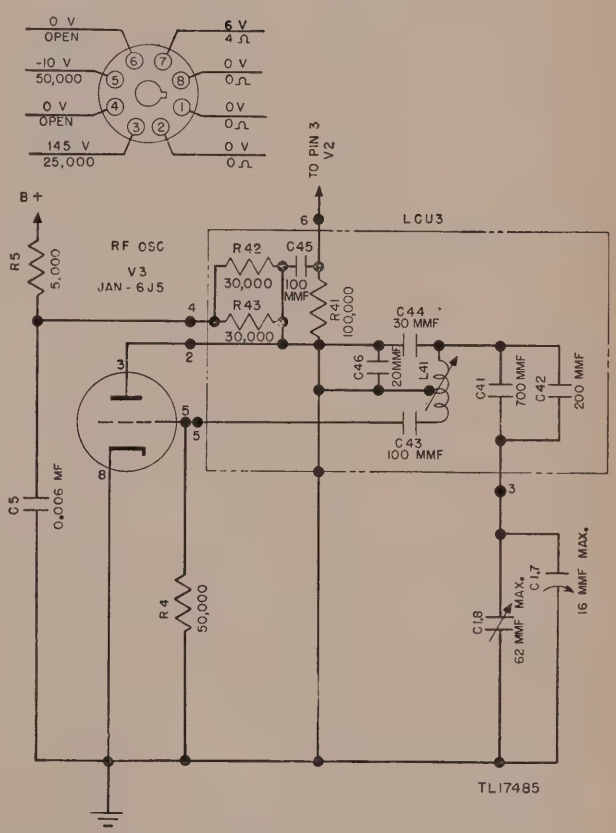


Figure 27.—Radio Receiver BC–603–(*), radio-frequency oscillator, V3—schematic diagram.

35. Parts List for First I-f Amplifier, V4 (fig. 28)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C63	3D9050–13	Capacitor, 50-mmf ±5%, 500 v dc, part of FL2.	First i-f plate fixed tuning.
C64	3D9010–5	Capacitor, 10 ±1-mmf, 500 v dc, part of FL2.	Temperature compensator for C63.
L62	2C4403A/C9.	Coil, part of FL2.	First i-f plate tuned coupling.
L61	2C4403A/C9.	Coil, part of FL2.	Second i-f grid tuned coupling.
C65	3D9010–5	Capacitor, 10 ±1-mmf, 500 v dc, part of FL2.	Temperature compensator for C66.
C66	3D9050–13	Capacitor, 50-mmf, ±5% 500 v dc, part of FL2.	Second i-f grid fixed tuning.
R62	3Z6643	Resistor, 43,000-ohm ±10%, part of FL2.	Second i-f input filter termination.
C61	3D9100–19A.	Capacitor, 100-mmf ±5%, 500 v dc, part of FL2.	Second i-f grid coupling.
R61	3Z4550	Resistor, 0.1-meg ±10%, part of FL2.	Second i-f grid leak.
C6	3DA6–10	Capacitor, 0.006-mf, 300 v dc.	First i-f screen bypass.
R7	3Z6630–8	Resistor, 30,000-ohm ±10%.	First i-f screen filter.
C67	3DA6–10	Capacitor, 0.006-mf 300 v dc, part of FL2.	First i-f plate filter.
R64	3Z4525	Resistor, 1,000-ohm ±10%, part of FL2.	First i-f plate filter.
C62	3DA1–22	Capacitor 0.001-mf, 500 v dc, part of FL2.	Second i-f grid filter.
R63	3Z4529	Resistor 10,000-ohm ±10%, part of FL2.	Second i-f grid filter.
P2	2Z7299	Potentiometer 200-ohm.	Squelch control.
C15	3DA500–30	Capacitor, 0.5-mf, 600 v dc.	A-v-c filter.
C14	3DA6–10	Capacitor, 0.006-mf, 300 v dc.	I-f a-v-c filter.
R13	3Z4529	Resistor 10,000-ohm ±10%.	A-v-c filter.

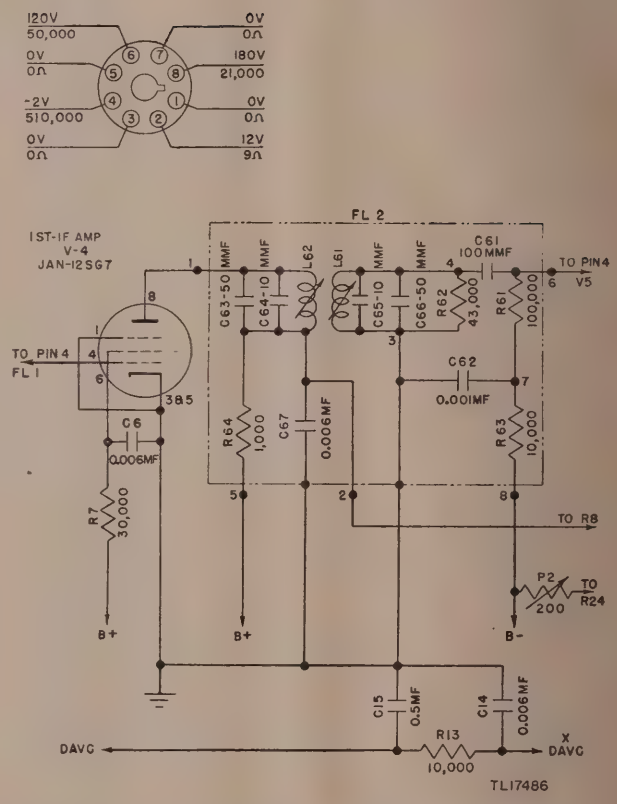


Figure 28. Radio Receiver BC–603–(*), first intermediate-frequency amplifier V4—schematic diagram.

36. Parts List for Second I-f Amplifier Stage, V5 (fig. 29)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C74	3D9010–S ..	Capacitor, 10 ±1-mmf 500 v dc, part of FL3.	Temperature compensator for C73.
C73	3D9050–13 ..	Capacitor, 50-mmf, ±5%, 500 v dc part of FL3.	Second i-f plate fixed tuning.
L72	2C4403A/C9.	Coil, part of FL3.....	Second i-f plate tuned coupling.
L71	2C4403A/C9.	Coil, part of FL3.....	Limiter grid tuned coupling.
C76	3D9050–13 ..	Capacitor, 50-mmf, ±5%, 500 v dc, part of FL3.	Limiter grid fixed tuning.
R72	3Z4540	Resistor 30,000-ohm, ±10%, part of FL3.	Limiter input filter termination.
C75	3D9010–5 ...	Capacitor, 10 ±1-mmf, 500 v dc part of FL3.	Temperature compensator for C76.
C71	3D9100–13 ..	Capacitor, 50-mmf ±5%, part of FL3.	Limiter input filter.
R71	3Z4562	Resistor, 250,000-ohm, ±10%, part of FL3.	Limiter grid leak.
C7	3DA6–10 ...	Capacitor, 0.006-mf 300 v dc.	Second i-f screen bypass.
R8	3Z6670–1 ...	Resistor 70,000-ohm, ±10%.	Second i-f filter.
C77	3DA6–10 ...	Capacitor, 0.006-mf, 300 v dc, part of FL3.	Second i-f plate filter.
R74	3Z4525	Resistor, 1,000-ohm, ±10%, part of FL3.	Second i-f plate filter.
C72	3DA122 ...	Capacitor 0.001-mf, 500 v dc, part of FL3.	Limiter grid filter.
R73	3Z4529	Resistor, 10,000-ohm, ±10%, part of FL3.	Limiter grid filter.
R24	3Z6005–13 ..	Resistor, 50-ohm, ±5%..	Voltage dividing network.
R25	3Z6250–6 ...	Resistor, 2,500-ohm, ±5%.	Voltage dividing network.
R21	3Z6630–7 ...	Resistor, 30,000-ohm, ±10%.	Voltage divider shunt.

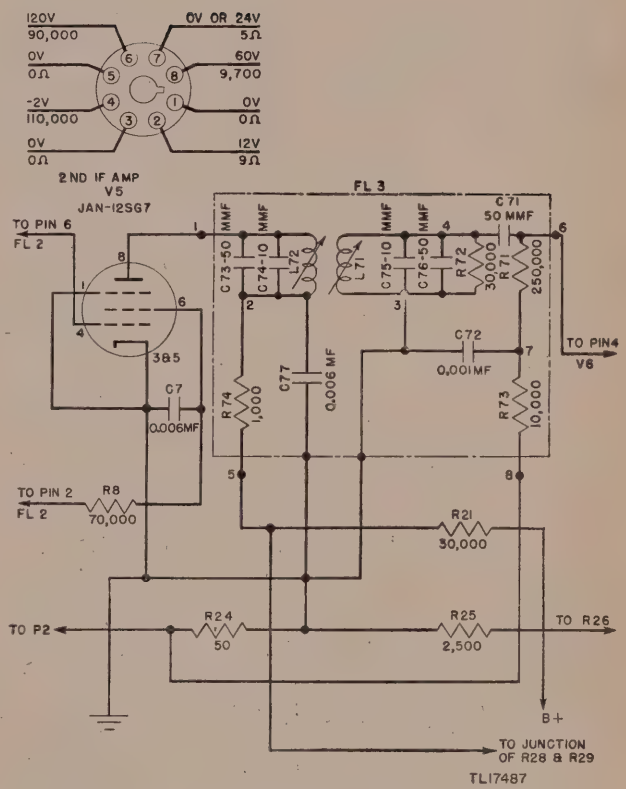


Figure 29. Radio Receiver BC–603–(*), second intermediate-frequency amplifier V5—schematic diagram.

37. Parts List for Limiter Stage, V6 (fig. 30)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C87	3D9025–4	Capacitor, 25-mmf ±5%, 500 v dc, part of FL4.	Limiter plate fixed tuning.
C88	309010–5	Capacitor, 10 ±1-mmf, 500 v dc, part of FL4.	Temperature compensator for C87.
L82	2C4403A/C9.	Coil part of FL4.	Limiter plate tuned coupling.
L81	2C4403A/C10	Coil part of FL4.	Detector input tuned coupling.
C85	309050–13	Capacitor, 50-mmf, ±2%, 500 v dc, part of FL4.	Half of slope circuit secondary tuning.
C86	309050–13	Capacitor, 50-mmf ±2%, 500 v dc, part of FL4.	Half of slope circuit secondary tuning.
C84	309005–13	Capacitor, 5 ±0.5-mmf, 500 v dc, part of FL4.	Temperature compensation for slope circuit secondary.
R81	3Z6670–1	Resistor, 70,000-ohm, ±10%, part of FL4.	Detector lead.
R83	3Z6670–1	Resistor, 70,000-ohm, ±10%, part of FL4.	Detector lead.
L1	3Z4403A/C7.	Choke (5C–1002)	Limiter cathode choke.
C8	309500–18	Capacitor, 500-mmf, 500 v dc.	Limiter screen filter.
C 9	3DA6–10	Capacitor, 0.006-mf, 500 v dc.	Limiter screen bypass.
R85	3Z4525	Resistor, 1,000-ohm, ±10%, part of FL4.	Limiter plate filter.
C83	3DA6–10	Capacitor 0.006-mf, 300 v dc, part of FL4.	Limiter plate filter.
C81	3D92500–9	Capacitor, 250-mf, ±10%, 500 v dc, part of FL4.	Detector r-f bypass.
R82	3Z4562	Resistor, 0.25-meg. ±10%, part of FL4.	Detector cathode bias.
R84	3Z4562	Resistor, 0.25-meg. ±10%, part of FL4.	Detector cathode bias.
C82	3DA6–10	Capacitor, 0.006-mf, 300 v dc, part of FL4.	Detector cathode filter.
C20.3	3DA100–27	Capacitor, 0.1-mf ±10%, 600 v dc.	Squelching voltage filter.
R21	3Z6630–7	Resistor, 30,000-ohm, ±10%.	Voltage divider shunt.
R26	3Z6120	Resistor, 1,200-ohm, ±5%.	Voltage dividing network.
R27	3Z6250–6	Resistor, 2,500-ohm, ±5%.	Voltage dividing network.
R28	3Z6250–6	Resistor, 2,500-ohm, ±5%.	Voltage dividing network.
R29	3Z6613	Resistor 13,000-ohm, ±5%.	Voltage dividing network.
R31	3Z6563–1	Resistor, 6,800-ohm, ±5%.	Voltage dividing network.
C10	3D8975	Capacitor, 0.75 ±0.25-mmf, 500 v dc.	I-f oscillator coupling.

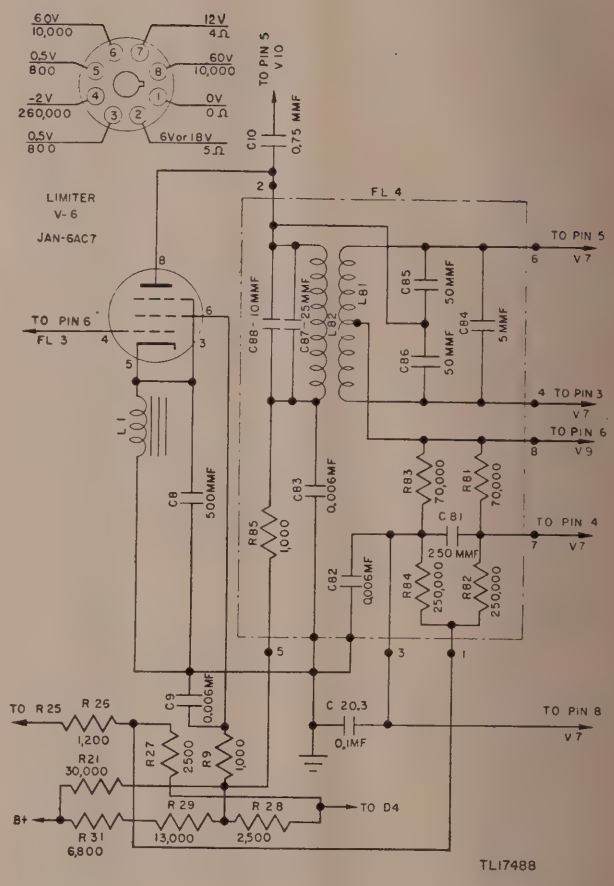


Figure 30. Radio Receiver BC–603–(*), limiter, V6—schematic diagram.

38. Parts List for Detector (Discriminator) Stage, V7 (fig. 31)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C88	3D9010-5 ..	Capacitor, 10 ±1-mmf, 500 v dc.	Temperature compensator for C87.
C87	3D9025-4 ..	Capacitor, 25-mmf, ±5% 500 v dc.	Limiter plate fixed tuning.
L82	2C4403A/C9.	Coil, part of FL4.....	Limiter plate tuned coupling.
L81	2C4403A/C10	Coil, part of FL4.....	Detector input tuned coupling.
C85	3D9050-13 ..	Capacitor, 50-mmf, ±2%, 500 v dc.	Half of slope circuit, secondary tuning.
C86	3D9050-13 ..	Capacitor, 50-mmf, ±2%, 500 v dc.	Half of slope circuit, secondary tuning.
C84	3D9050-13...	Capacitor, 5 ±0.5-mmf, 500 v dc.	Temperature compensation for slope circuit, secondary
R81	3Z6670-1 ..	Resistor, 70,000-ohm, ±10%, part of FL4.	Detector load.
R83	3Z6670-1 ..	Resistor, 70,000-ohm, ±10%, part of FL4.	Detector load.
R82	3Z4562	Resistor, 0.25-meg, ±10%, part of FL4.	Detector cathode bias.
R84	3Z4562	Resistor, 0.25-meg, ±10%, part of FL4.	Detector cathode bias.
R10	3Z4562	Resistor, 0.25-meg, ±10%.	First audio grid coupling.
C11	3DA6-10	Capacitor, 0.006-mf, 300 v dc.	First audio grid coupling.
C82	3DA6-10 ...	Capacitor, 0.006-mf, 300 v dc, part of FL4.	Detector cathode filter.
C20.3 ...	3DA100-27 .	Part of capacitor (3 x 0.1 mf) 600 v dc.	Detector cathode filter.
C83	3DA6-10 ...	Capacitor, 0.006-mf, 300 v dc, part of FL4.	Limiter plate filter.
R85	3Z4525	Resistor, 1,000-ohm, ±10%, part of FL4.	Limiter plate filter.

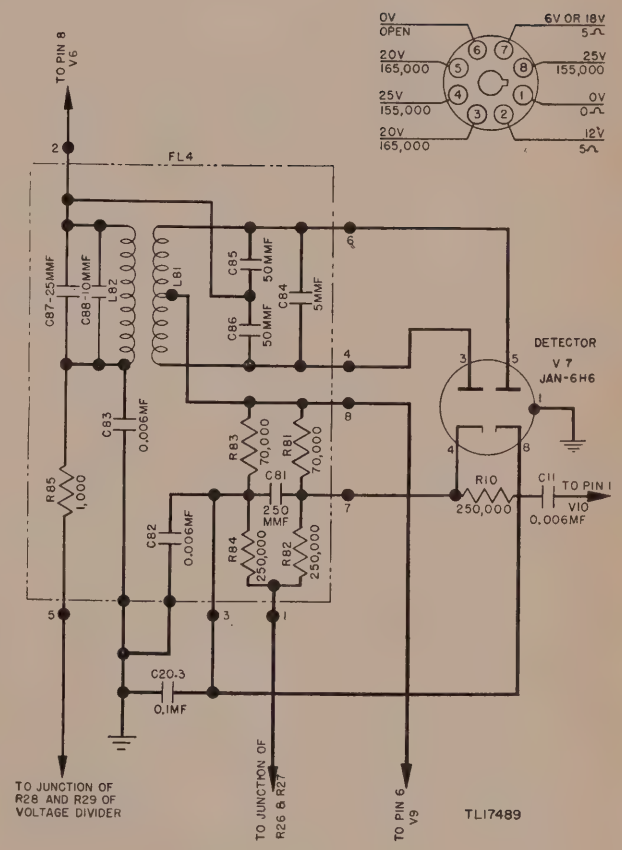


Figure 31. Radio Receiver BC-603-(*), detector (discriminator), V7—schematic diagram.

39. Parts List for First Audio-amplifier Stage, V10' (fig. 32)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C13	3D9500–18 .	Capacitor, 500-mmf, 500 v dc.	High frequency cut-off, first audio grid.
R11	3Z4534	Resistor, 1 meg, ±10%..	First audio grid leak.
C12	3DA10–48 ..	Capacitor, 0.01-mf, 300 v dc.	First audio grid bias filter.
R17	3Z4562	Resistor, 0.25-meg. ±10%.	Squelch plate load.
R12	3Z6200–17 ..	Resistor, 2,000-ohm, ±10%.	First audio cathode bias.
C20.2 ...	3DA100–27 .	Capacitor, 0.1-mf, 600 v dc.	Squelching voltage filter.
R18	3Z4550	Resistor, 0.1-meg, ±10%,	First audio plate.
R19	3Z4542	Resistor, 2-meg, ±10%..	Indicator lamp shunt.
E1	2Z5893–1 ...	Lamp, neon	Indicator lamp.
C21	3DA10–48 ..	Capacitor, 0.01-mf, 300 v dc.	Second audio grid coupling.

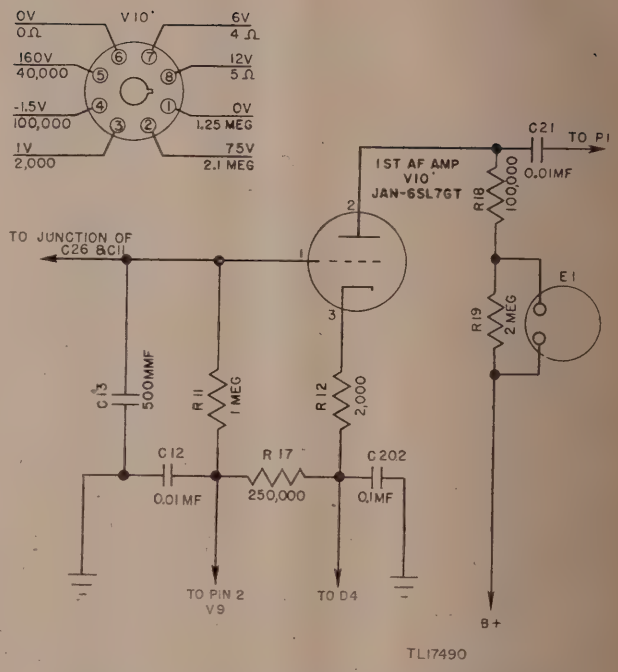


Figure 32. Radio Receiver BC–603–(*), first audio-frequency amplifier, V10'—schematic diagram.

40. Parts List for Second Audio-amplifier Stage, V8 (fig. 33)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
C21	3DA10–48 ..	Capacitor, 0.01-mf 300 v dc.	Second audio grid coupling.
P1	2Z7298	Potentiometer, 100,000-ohm taper C.	Volume control.
C19	3DA2–16 ...	Capacitor, 0.002-mf, 500 v dc.	High-frequency cut-off, second audio grid.
C23	3DB40–1 ...	Capacitor, 40-mf, 25 v dc.	Second audio cathode bypass.
R20	3Z6030–11 ..	Resistor, 300-ohm, ±10%.	Second audio cathode bias.
C22	3DA5–8	Capacitor, 0.005-mf, 300 v dc.	High-frequency cut-off, second audio plate.
T1	2C4403A/T3.	Audio output transformer (S0–1005).	Audio output.
R30	3Z4805	Resistor, 5-ohm ±5%...	Audio output dummy load.
R22	3Z4540	Resistor, 30,000-ohm, ±10%.	Phone series.
R32	3Z4540	Resistor, 30,000-ohm, ±10%.	Phone series.
R33	3Z4540	Resistor, 30,000-ohm, ±10%.	Phone series.
C24	3DB1.6100A.	Capacitor, 1-mf, 600 v dc.	Second audio screen bypass.
R23	3Z4528	Resistor, 5,000-ohm, ±10.%	Second audio screen filter.
C25	3DB2.88A ..	Capacitor, 2-mf, 600 v dc.	Plate supply filter.
D2	2C4403A/S2.	Switch, SPST	Headset.
D3	2C4403A/S4.	Switch, SPST	Loud speaker.
D5	Information not available.	Switch, DPST	Tune-operate.
J1	2C4403A/P3.	Jack, part of jack assembly.	Headset.
J2	2C4403A/P3.	Jack, part of jack assembly.	Headset.

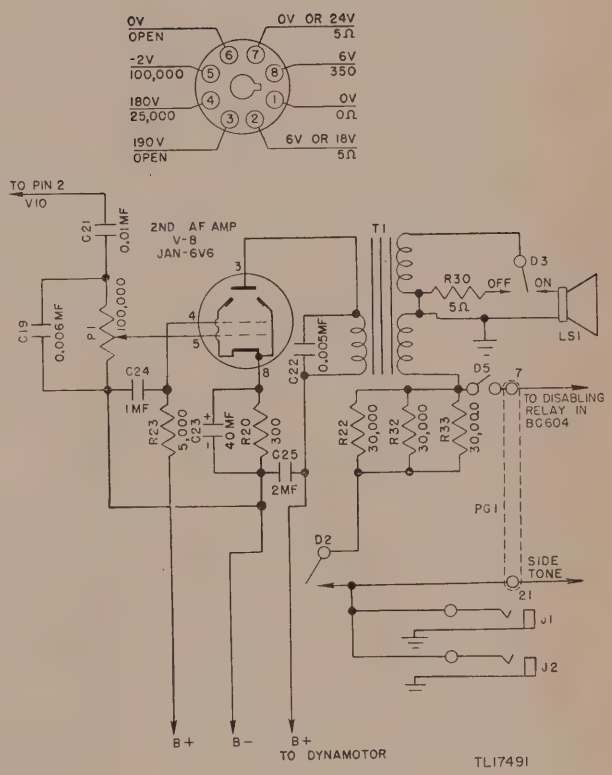


Figure 33. Radio Receiver BC–603–(*), second audio-frequency amplifier, V8—schematic diagram.

41. Parts List for Delayed A-V-C Circuit V9' (fig. 34)

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
R14	3Z4562	Resistor, 0.25-meg. +10%.	A-v-c bias
P2	2Z7299	Potentiometer, 200-ohm ..	Squelch control.
R24	3Z600–13 ...	Resistor, 50-ohm, ±5%..	Voltage dividing network.
R15	3Z4534	Resistor, 1-meg, ±10%..	Squelch timing.
D4	2C4403A/S3.	Switch, SPST and SPDT.	Squelch.

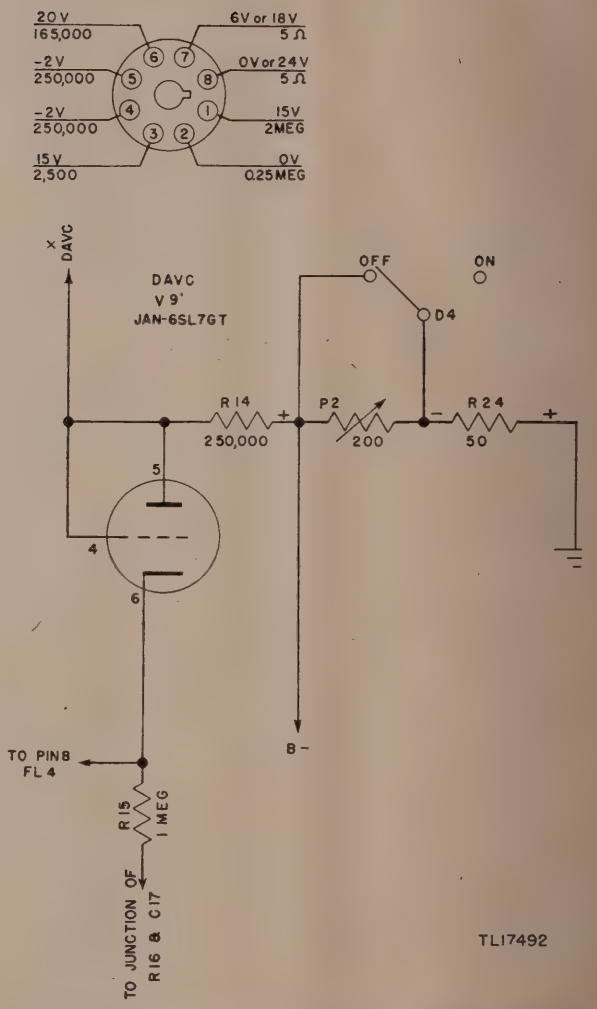


Figure 34. Radio Receiver BC-603-(*), delayed automatic volume control, V9'—schematic diagram.

42. Parts List for Squelch Circuit, V9" (fig. 35)

Ref. symbol	Signal Corps stock No.	Name of part and description	Function
R15	3Z4534	Resistor, 1-meg, ±10%..	Squelch timing.
R16	3Z4534	Resistor, 1-meg, ±10%..	Squelch timing.
R17	3Z4562	Resistor, 0.25-meg, ±10%.	Squelch plate load.
R12	3Z6200–17	Resistor, 2,000-ohm, ±10%.	First audio cathode bias.
R11	3Z4534	Resistor, 1-meg, ±10%..	First audio grid leak.
C12	3DA10–48	Capacitor, 0.01-mf, 300 v dc.	First audio grid-bias filter.
C20.2	3DA100–27	Capacitor, 0.1-mf, 600 v dc.	Squelching voltage filter.
C18	3DA10–48	Capacitor, 0.01-mf, 300 v dc.	Squelch timing.
R25	3Z6250–6	Resistor, 2,500-ohm, ±5%.	Voltage dividing network.
R26	3Z6120	Resistor, 1,200-ohm, ±5%.	Voltage dividing network.
R27	3Z6250–6	Resistor, 2,500-ohm, ±5%.	Voltage dividing network.
R28	3Z6250–6	Resistor, 2,500-ohm, ±5%.	Voltage dividing network.
R29	3Z6613	Resistor, 13,000-ohm, ±5%.	Voltage dividing network.
R31	3Z6568–1	Resistor, 6,800-ohm, ±5%.	Voltage dividing network.
R21	3Z6630–7	Resistor, 30,000-ohm, ±10%.	Voltage divider shunt.
R95	3Z4614	Resistor, 5,000-ohm, ±10%.	Voltage divider.
R96	3Z4540	Resistor, 30,000-ohm, ±10%.	Voltage divider.
C16	3DB2.6020	Capacitor, 2-mf, 600 v dc.	Plate supply filter.
P2	2Z7299	Potentiometer, 200-ohm ..	Squelch control.
R24	3Z6005–13	Resistor, 30-ohm ±5%...	Voltage dividing network.
C17	3DA10–48	Capacitor, 0.01-mf, 300 v dc.	Squelch timing.
D4	2C4403A/S3.	Switch, SPST-SPDT	Squelch.

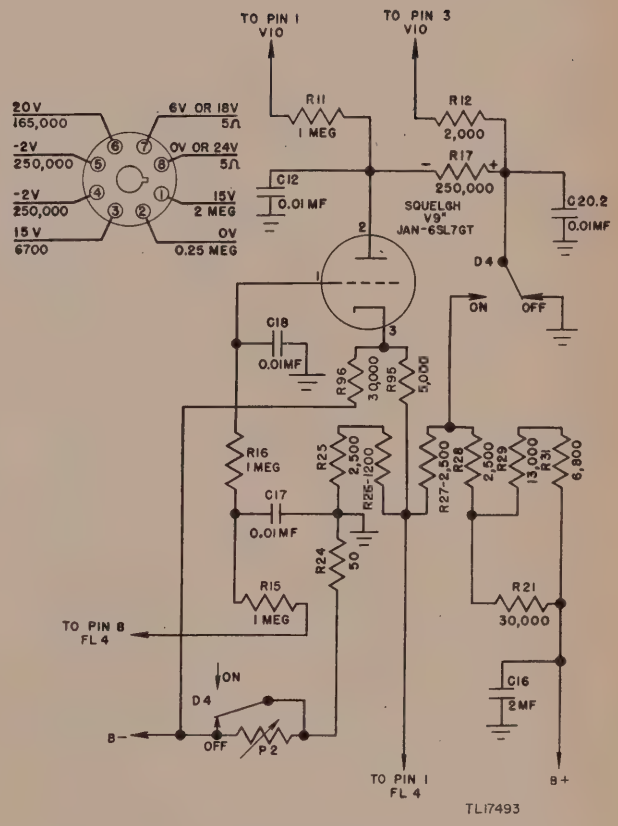


Figure 35. Radio Receiver BC–603–(*), squelch V9"—schematic diagram.

43. Parts List for I-f Oscillator Stage, V10"

(fig. 36)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
L91	2C4403A/C14	Coil, part of LCU4.....	I-f oscillator inductance.
R91	2Z4550	Resistor, 0.1-meg, ±10%, part of LCU4.	I-f oscillator grid leak.
R93	3D9100–19A.	Capacitor, 0.75 ±0.25-mmf, 500 v dc.	I-f oscillator fixed tuning.
C10	3D8975	Capacitor, 0.75 ±0.25-mmf, 500 v dc.	I-f oscillator coupling.
R6	3Z4550	Resistor, 0.1-meg, ±10%.	I-f oscillator coupling.
C26	3D9500	Capacitor, 0.0005-mf 500 v dc.	I-f oscillator coupling.
R92	3Z4549	Resistor, 40,000-ohm, ±10%, part of LCU4.	I-f oscillator plate load.
R93	3Z4549	Resistor, 40,000-ohm, ±10%, part of LCU4.	I-f oscillator plate load.
C92	3D370	Capacitor, 50 ± 2-mmf, 500 v dc, part of LCU4.	I-f oscillator plate shunt.
C94	3D9050–13 ..	Capacitor, 50-mmf, ±5%, 500 v dc, part of LCU4.	I-f oscillator plate coupling.
C91	3D9050–13 ..	Capacitor, 50-mmf, ±5%, 500 v dc, part of LCU4.	I-f oscillator plate shunt.

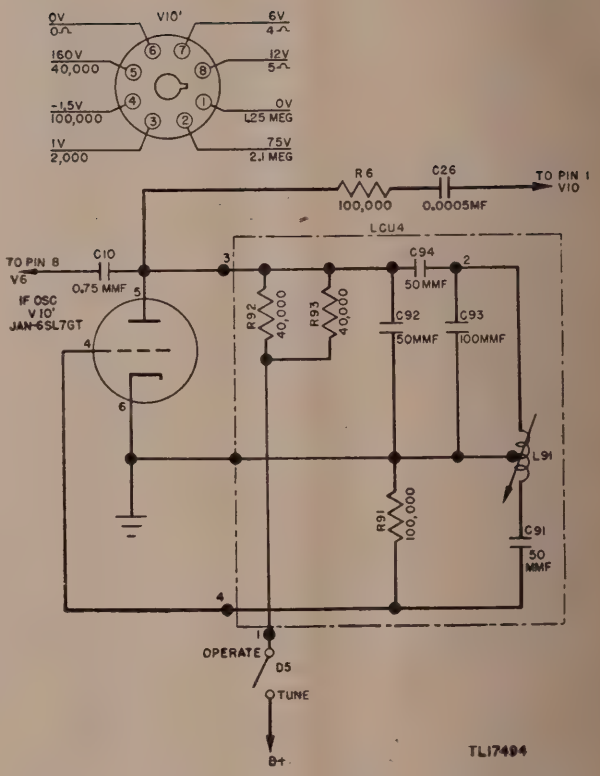


Figure 36. Radio Receiver BC–603–(*), intermediate frequency oscillator, V10"—schematic diagram.

SECTION IX

SUPPLEMENTARY DATA

44. Parts Identification

The following illustrations are provided to aid in identifying and servicing the various component parts of Radio Receivers BC–603–A, –C, –D, –AM, –CM, and –DM.

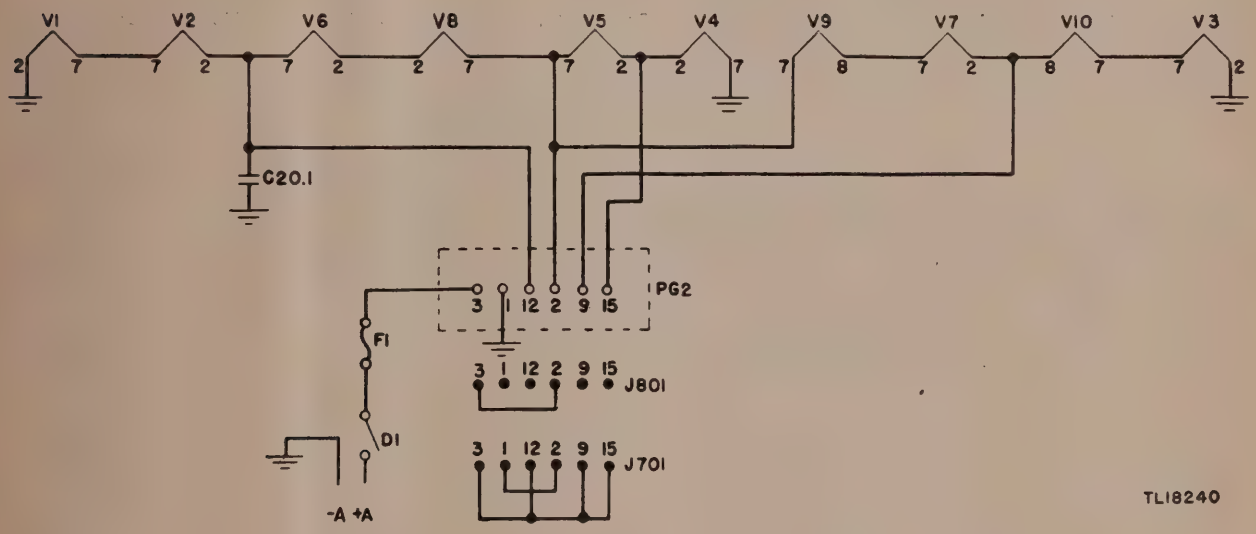
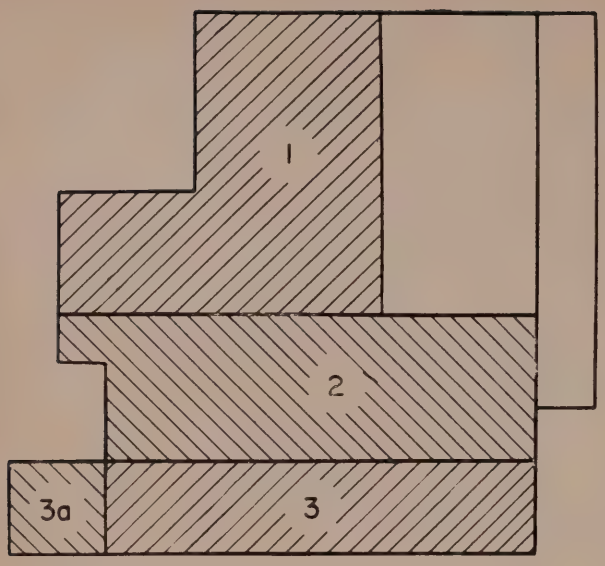


Figure 37. Radio Receiver BC–603–(*), functional diagram of vacuum-tube heater circuits.

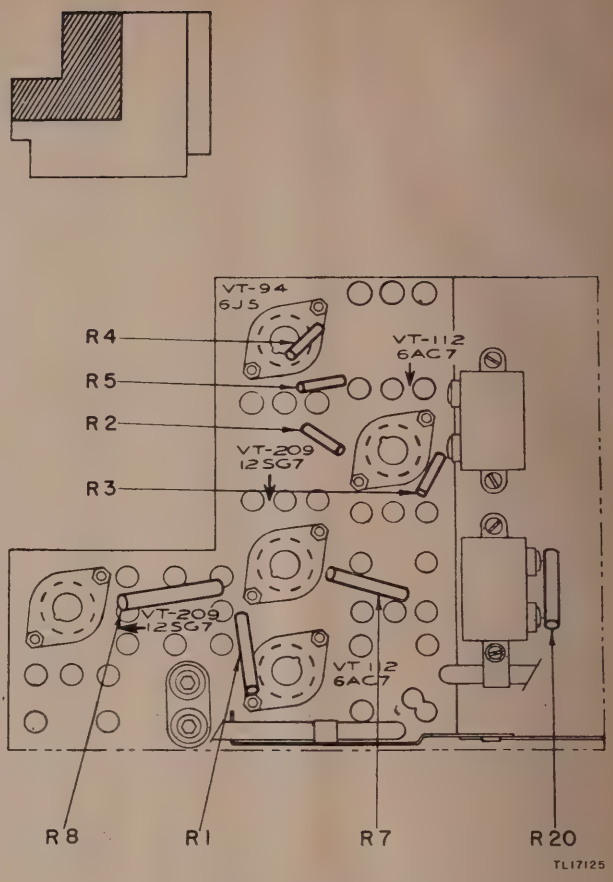


LOCATION OF RESISTORS	
AREA	REFER TO FIGURE
1	38b
2	38c
3	38d
3a	38d

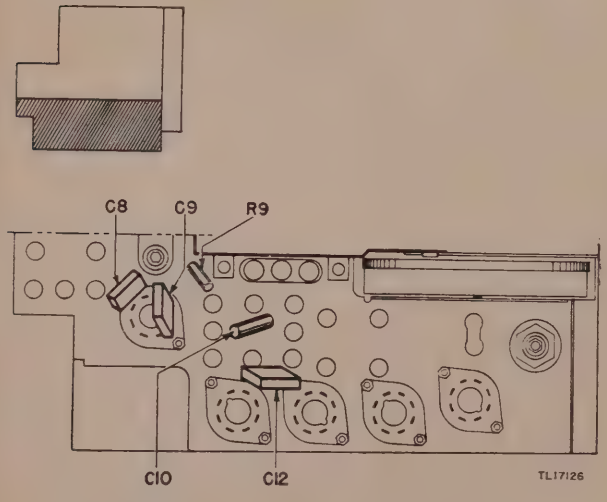
LOCATION OF CAPACITORS	
AREA	REFER TO FIGURE
1	38e
2	38c
3	38f
3a	38f

TL 51012-S

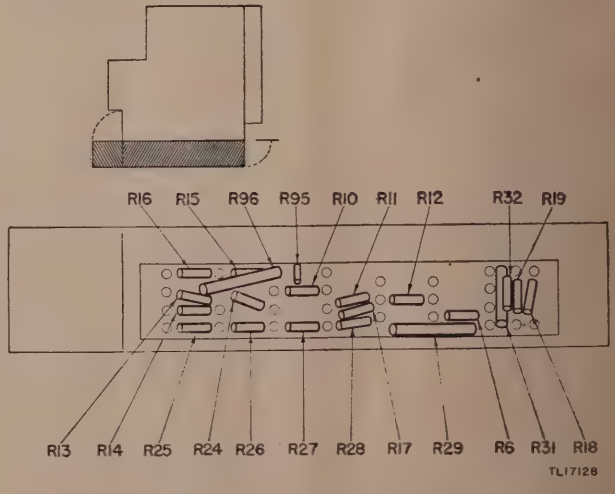
① *Key and legend for location of resistors and capacitors.*



② *Location of resistors—area 1.*

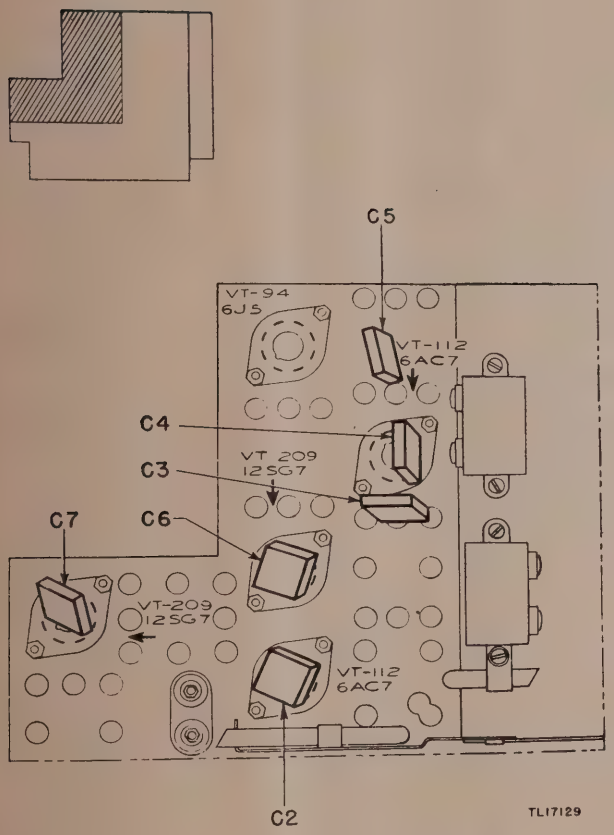


③ *Location of resistors and capacitors—area 2.*

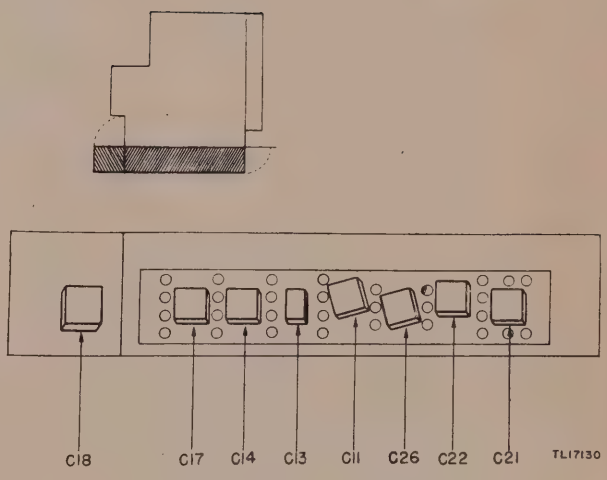


④ *Location of resistors—area 3.*

Figure 38. Radio Receiver BC–603–(*).

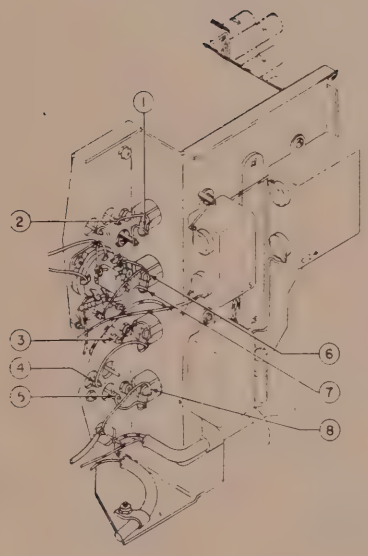


(5) *Location of capacitors—area 1.*

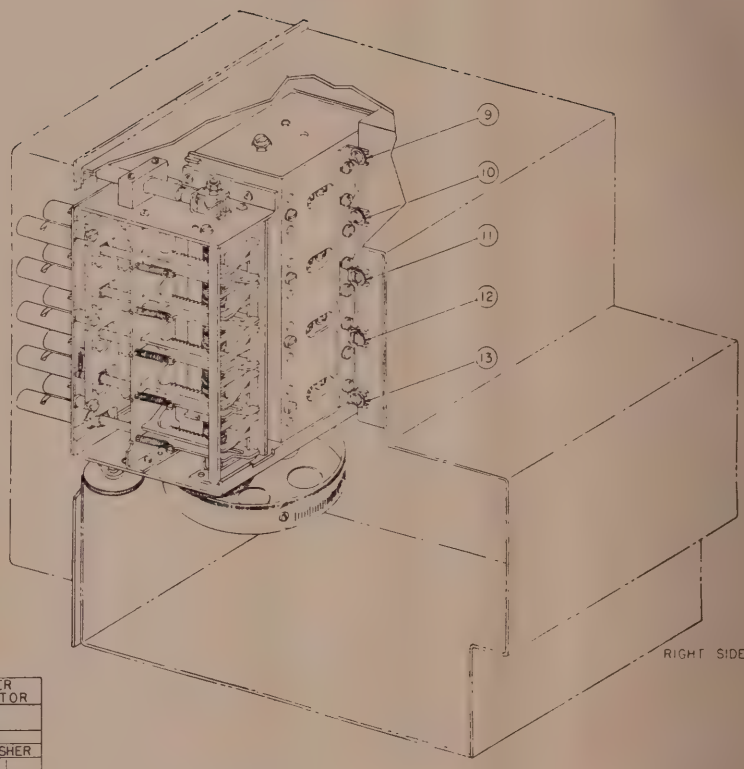


(6) *Location of capacitors—area 3.*

Figure 38—Continued.



LEFT SIDE VIEW



RIGHT SIDE VIEW

REMOVAL OF RECEIVER PUSH BUTTON SELECTOR SEQUENCE OF OPERATIONS	
STEP	OPERATION
1	UNSOLDER WIRE
2	
3	
4	
5	
6	
7	
8	

REMOVAL OF RECEIVER PUSH BUTTON SELECTOR SEQUENCE OF OPERATIONS	
STEP	OPERATION
9	REMOVE SCREW & WASHER
10	
11	
12	
13	

TL17103

Figure 39. Radio Receiver BC–603–(*)— removal of push-button assembly.

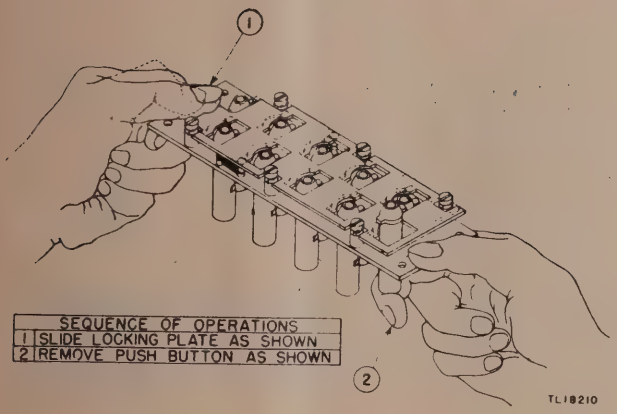
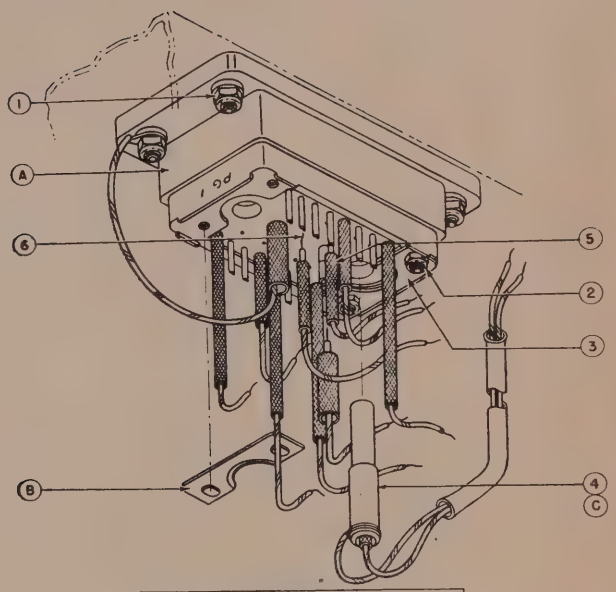


Figure 40. Radio Receiver BC–603–(*)—removal of individual push buttons.



PARTS LIST	
A	PG I CONNECTOR
B	COAXIAL LOCKING PLATE
C	COAXIAL CONNECTOR

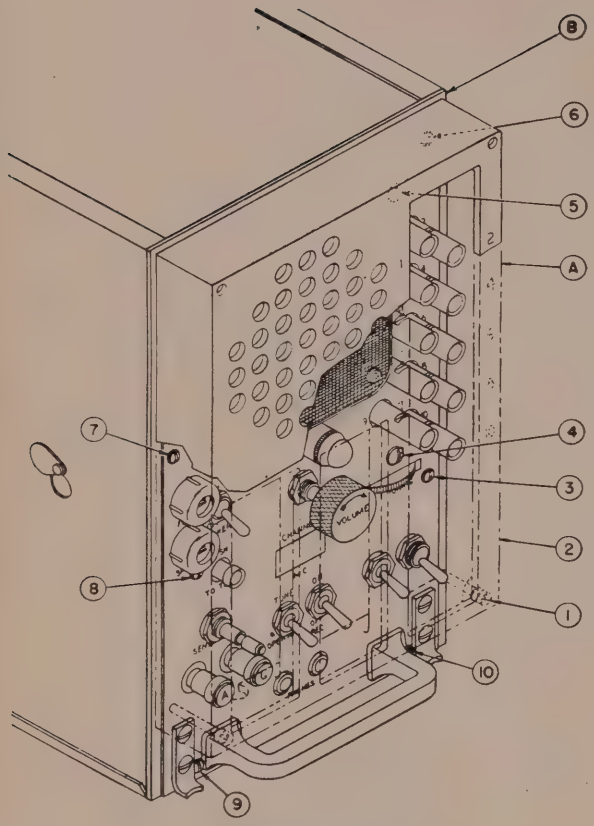
FOR REMOVAL OF PG I CONNECTOR SEQUENCE OF OPERATIONS	
STEP	OPERATION
1	REMOVE FOUR (4) ELASTIC STOP NUTS AND SLEEVES

FOR REMOVAL OF COAXIAL CONNECTOR SEQUENCE OF OPERATIONS	
STEP	OPERATION
2	REMOVE TWO (2) ELASTIC STOP NUTS
3	REMOVE COAXIAL CONNECTOR LOCKING PLATES
4	REMOVE COAXIAL CONNECTOR

FOR REMOVAL OF WIRES SEQUENCE OF OPERATIONS	
STEP	OPERATION
5	PULL BACK WIRE SLEEVING
6	UNSOLDER AS SHOWN

TL18218

Figure 41. Radio Receiver BC–603–(*)—removal of plug PG1.



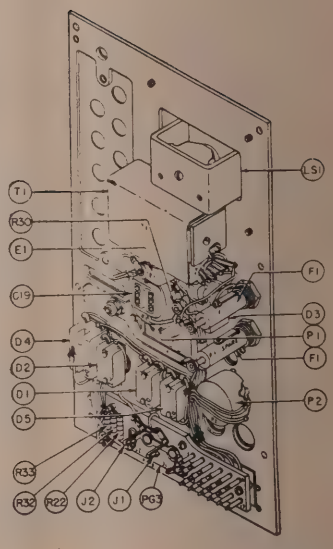
PARTS LIST	
A	PANEL GUARD
B	FRONT PANEL

SEQUENCE OF OPERATIONS	
STEP	OPERATION
1	REMOVE 4 PANEL GUARD SCREWS
2	REMOVE GUARD
3	UNSCREW
4	
5	
6	
7	
8	
9	
10	

TL17146

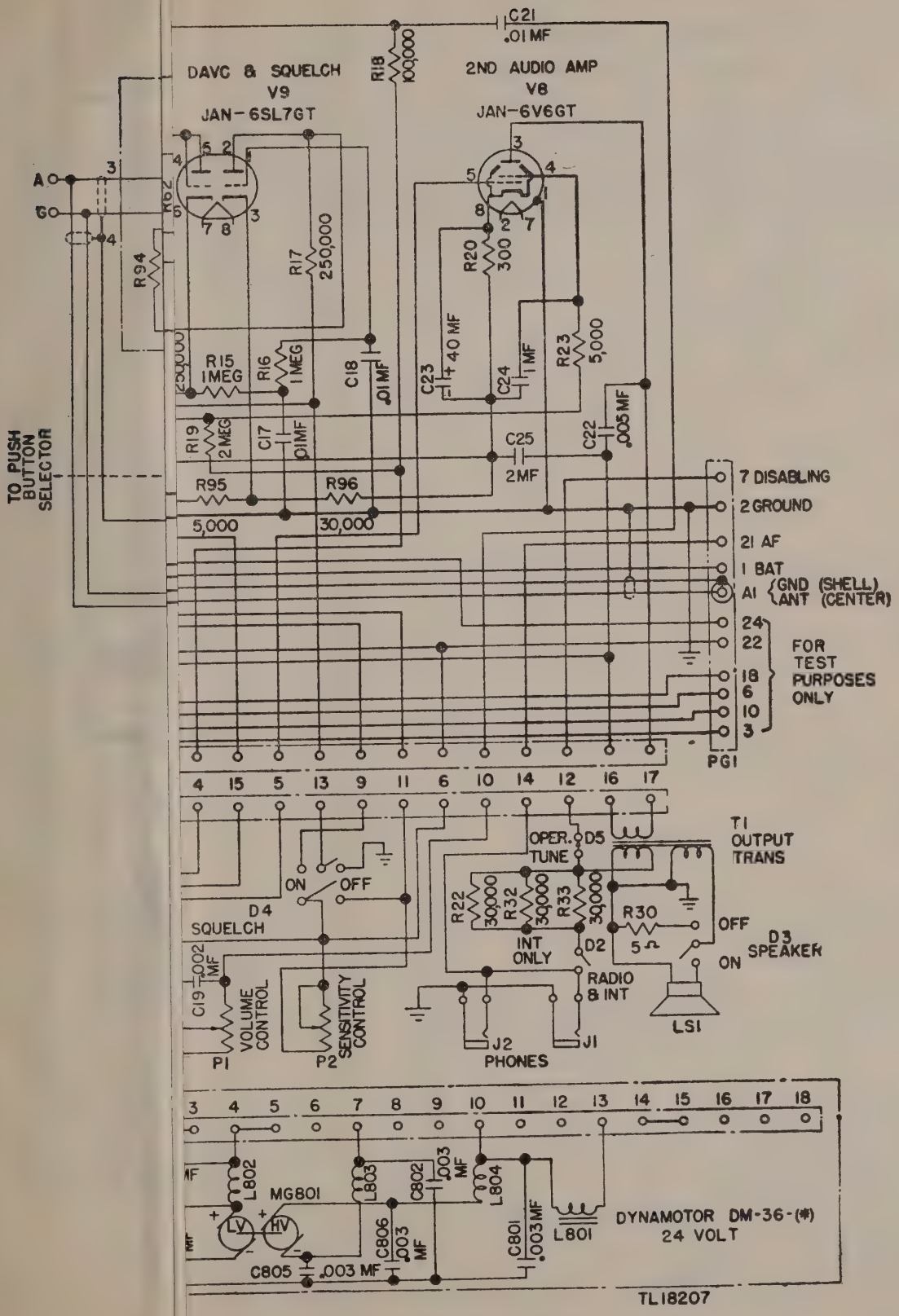
Figure 42. Radio Receiver BC-603-(*)— removal of front panel.

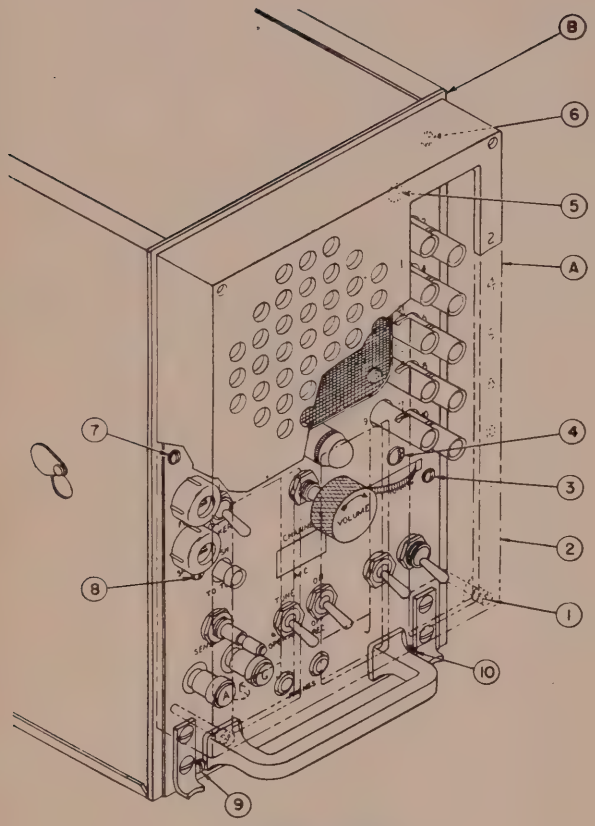
PARTS LIST	
T1	OUTPUT TRANSFORMER
E1	CALL SIGNAL
F1	FUSE 15 AMP
F1	FUSE 15 AMP (SPARE)
P1	VOLUME CONTROL
P2	SENSITIVITY CONTROL
PG3	FRONT PANEL PLUG
D1	ON-OFF REC
D2	RADIO B INTERPHONE SWITCH
D3	ON-OFF SPEAKER SWITCH
D4	SQUELCH ON OFF SWITCH
D5	TUNE-OPERATE SWITCH
C19	CAPACITOR 0.002 MF 500V
LS1	LOUD SPEAKER
R22	30,000 Ω ½W
R30	RESISTOR 5 Ω 4W
R32	30,000 Ω ½W
R33	30,000 Ω ½W
J1	PHONES
J2	PHONES



TL 51011-S

Figure 43. Radio Receiver BC-603-(*)— rear view of front panel.


DAVC & SQUELCH
V9
JAN-6SL7GT
2ND AUDIO AMP
V8
JAN-6V6GT
R18 100,000
C21 .01 MF
R94
R17 250,000
R15 1MEG
R16 1MEG
C18 .01 MF
R19 2 MEG
C17 .01MF
R20 300
C23 40 MF
C24 1 MF
R23 5,000
C22 .005 MF
C25 2MF
R95 5,000
R96 30,000
TO PUSH BUTTON SELECTOR
7 DISABLING
2 GROUND
21 AF
1 BAT
A1 GND (SHELL) ANT (CENTER)
24
22
18
6
10
3
FOR TEST PURPOSES ONLY
PG1
4 15 5 13 9 11 6 10 14 12 16 17
T1 OUTPUT TRANS
OPER. TUNE
D5
ON
OFF
D4 SQUELCH
R22 30000
R32 30000
R33 30000
R30
OFF
ON
D3 SPEAKER
5Ω
INT ONLY
D2
RADIO & INT
C19 .002 MF
VOLUME CONTROL
SENSITIVITY CONTROL
P1
P2
J2 PHONES
J1
LS1
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
L802
MG801
LV
HV
L803
C802 .003 MF
L804
C806 .003 MF
C805 .003 MF
C801 .003 MF
L801
DYNAMOTOR DM-36-(*)
24 VOLT
TL18207



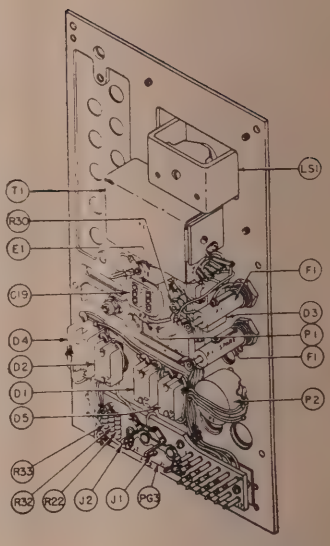
PARTS LIST	
A	PANEL GUARD
B	FRONT PANEL

SEQUENCE OF OPERATIONS	
STEP	OPERATION
1	REMOVE 4 PANEL GUARD SCREWS
2	REMOVE GUARD
3	UNSCREW
4	↓
5	↓
6	↓
7	↓
8	↓
9	↓
10	↓

TL17146

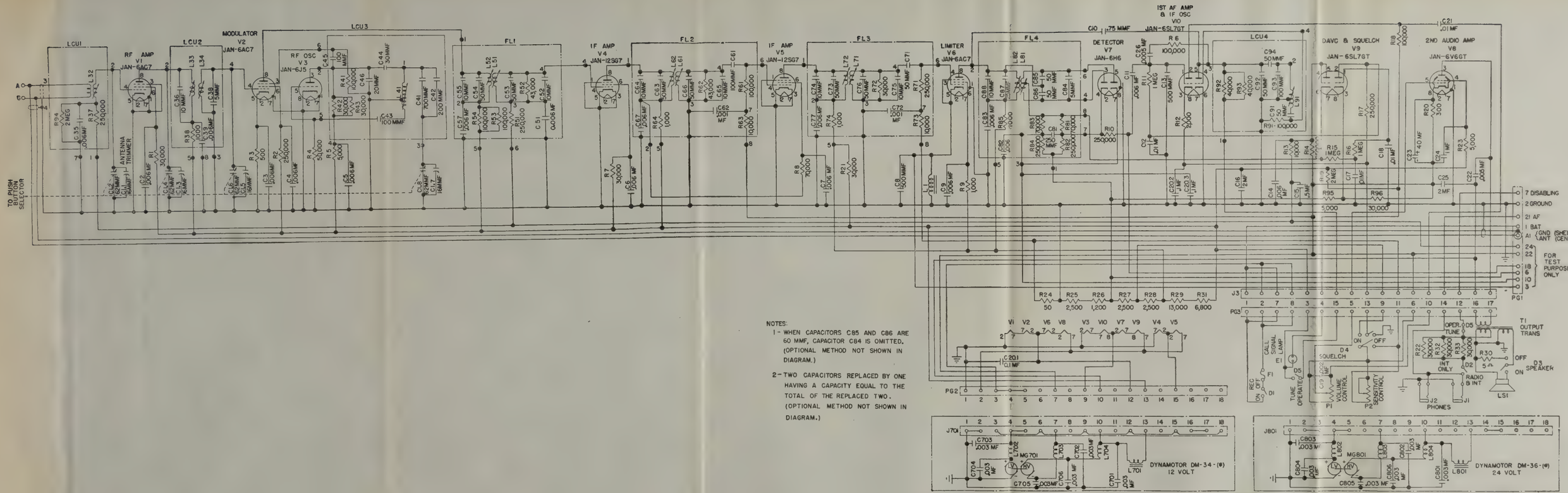
Figure 42. Radio Receiver BC-603-(*)— removal of front panel.

PARTS LIST	
T1	OUTPUT TRANSFORMER
E1	CALL SIGNAL
F1	FUSE 15 AMP
F1	FUSE 15 AMP (SPARE)
P1	VOLUME CONTROL
P2	SENSITIVITY CONTROL
PG3	FRONT PANEL PLUG
D	ON-OFF REC
D2	RADIO & INTERPHONE SWITCH
D3	ON-OFF SPEAKER SWITCH
D4	SQUELCH ON-OFF SWITCH
D5	TUNE-OPERATE SWITCH
C19	CAPACITOR 0.002 MF 500 V
LS1	LOUD SPEAKER
R22	30,000 Ω ½ W
R30	RESISTOR 5 Ω 4 W
R32	30,000 Ω ½ W
R33	30,000 Ω ½ W
J1	PHONES
J2	PHONES



TL 51011-S

Figure 43. Radio Receiver BC-603-(*)— rear view of front panel.

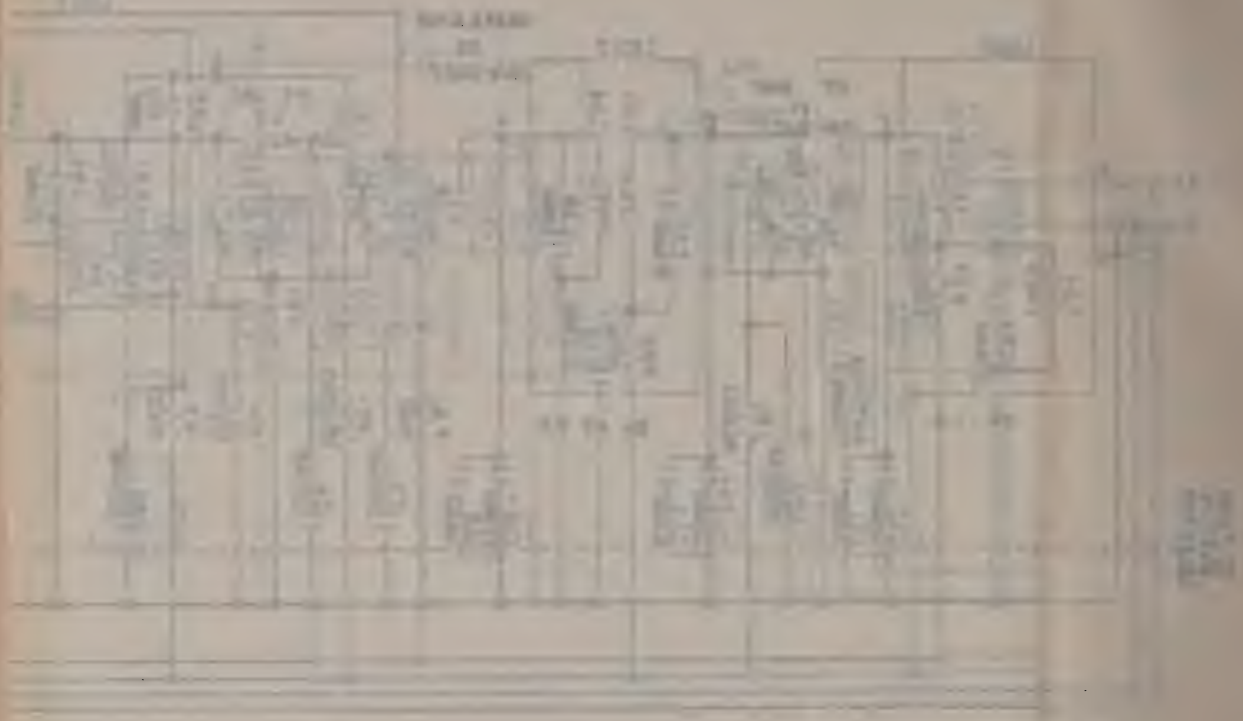


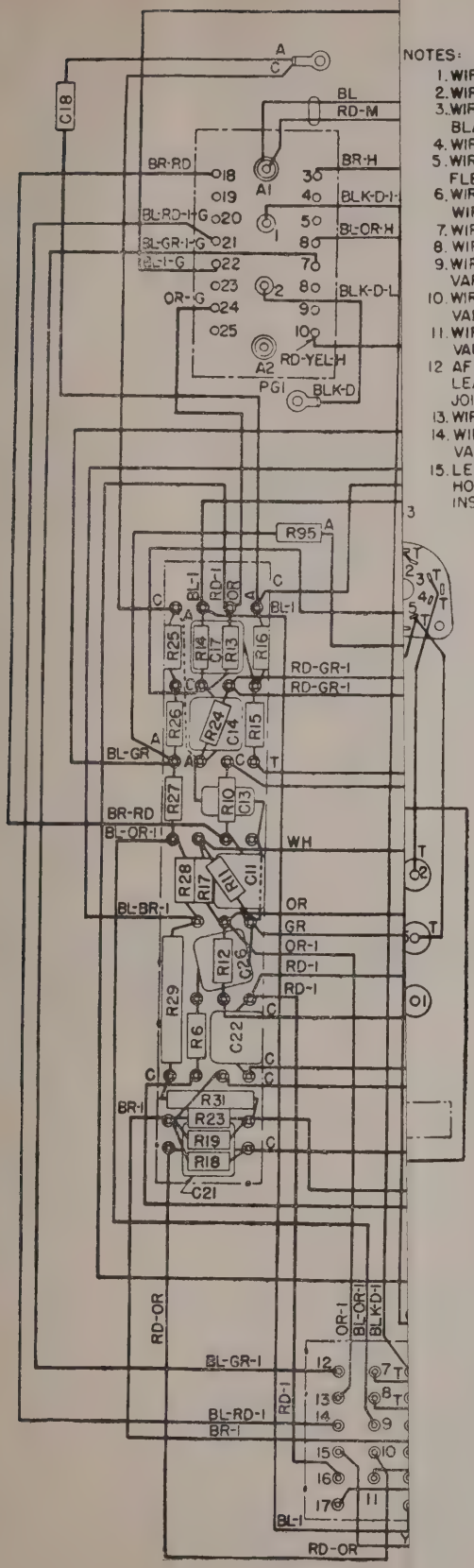
NOTES:

1- WHEN CAPACITORS C85 AND C86 ARE 60 MMF, CAPACITOR C84 IS OMITTED. (OPTIONAL METHOD NOT SHOWN IN DIAGRAM.)

2- TWO CAPACITORS REPLACED BY ONE HAVING A CAPACITY EQUAL TO THE TOTAL OF THE REPLACED TWO. (OPTIONAL METHOD NOT SHOWN IN DIAGRAM.)

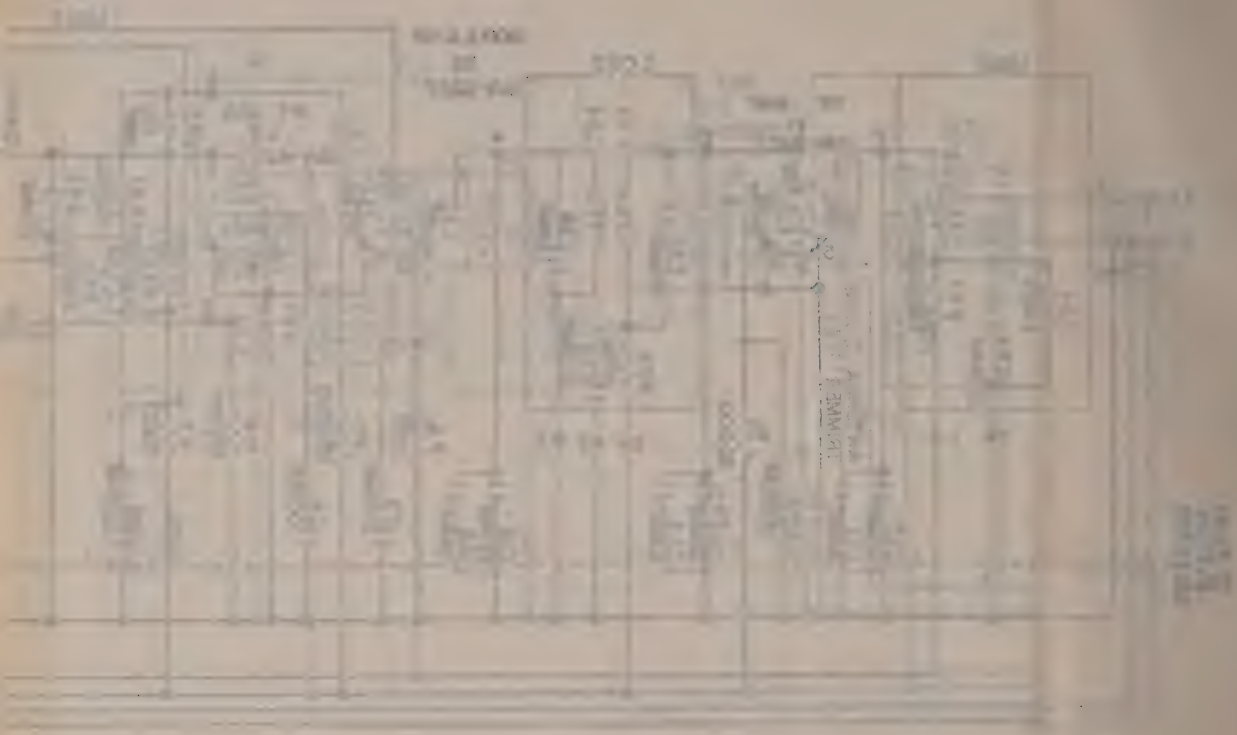
Figure 44. Radio Receiver BC-603-(*)—schematic diagram.





NOTES:

1. WIRE COLORS SPECIFIED ARE TRACER COLORS ON WHITE WIRE.
2. WIRES MARKED "A" ARE FURNISHED WITH APPARATUS.
3. WIRES MARKED "C" ARE NO. 18 A.W.G.A. "T" WIRES COVERED WITH NO. 18 BLACK FLEXIBLE VARNISHED TUBING.
4. WIRES MARKED "D" ARE NO. 16 A.W.G.A. STRANDED WIRE.
5. WIRES MARKED "E" ARE "A" WIRES COVERED WITH NO. 18 BLACK FLEXIBLE VARNISHED TUBING.
6. WIRES MARKED "T" ARE NO. 18 OR NO. 20 A.W.G.A. TINNED COPPER WIRE, SEE NOTE 15.
7. WIRES MARKED "1" ARE IN CABLE NO. 1.
8. WIRES MARKED "2" ARE IN CABLE NO. 2.
9. WIRES MARKED "G" ARE COVERED WITH YELLOW FLEXIBLE VARNISHED TUBING, 1 IN. LONG AT PGI.
10. WIRES MARKED "H" ARE COVERED WITH YELLOW FLEXIBLE VARNISHED TUBING, 2 IN. LONG AT PGI.
11. WIRES MARKED "L" ARE COVERED WITH YELLOW FLEXIBLE VARNISHED TUBING, 1/2 IN. LONG AT PGI.
12. AFTER PLACING YELLOW TUBING OVER LEADS AT PGI, SOLDER LEADS TO TERMINALS AND SLIP TUBING OVER SOLDERED JOINT UNTIL IT BEARS AGAINST FACE OF RECEPTACLE.
13. WIRES NOT DESIGNATED ARE NO. 20 A.W.G.A. SOLID WIRE.
14. WIRES MARKED "M" ARE COVERED WITH YELLOW FLEXIBLE VARNISHED TUBING, 1/2 IN. LONG AT PGI.
15. LEADS TO BE AS SHORT AND AS STRAIGHT AS POSSIBLE HOWEVER LEADS MAY BE FORMED WHERE NECESSARY TO INSURE AGAINST ACCIDENTAL SHORTS.



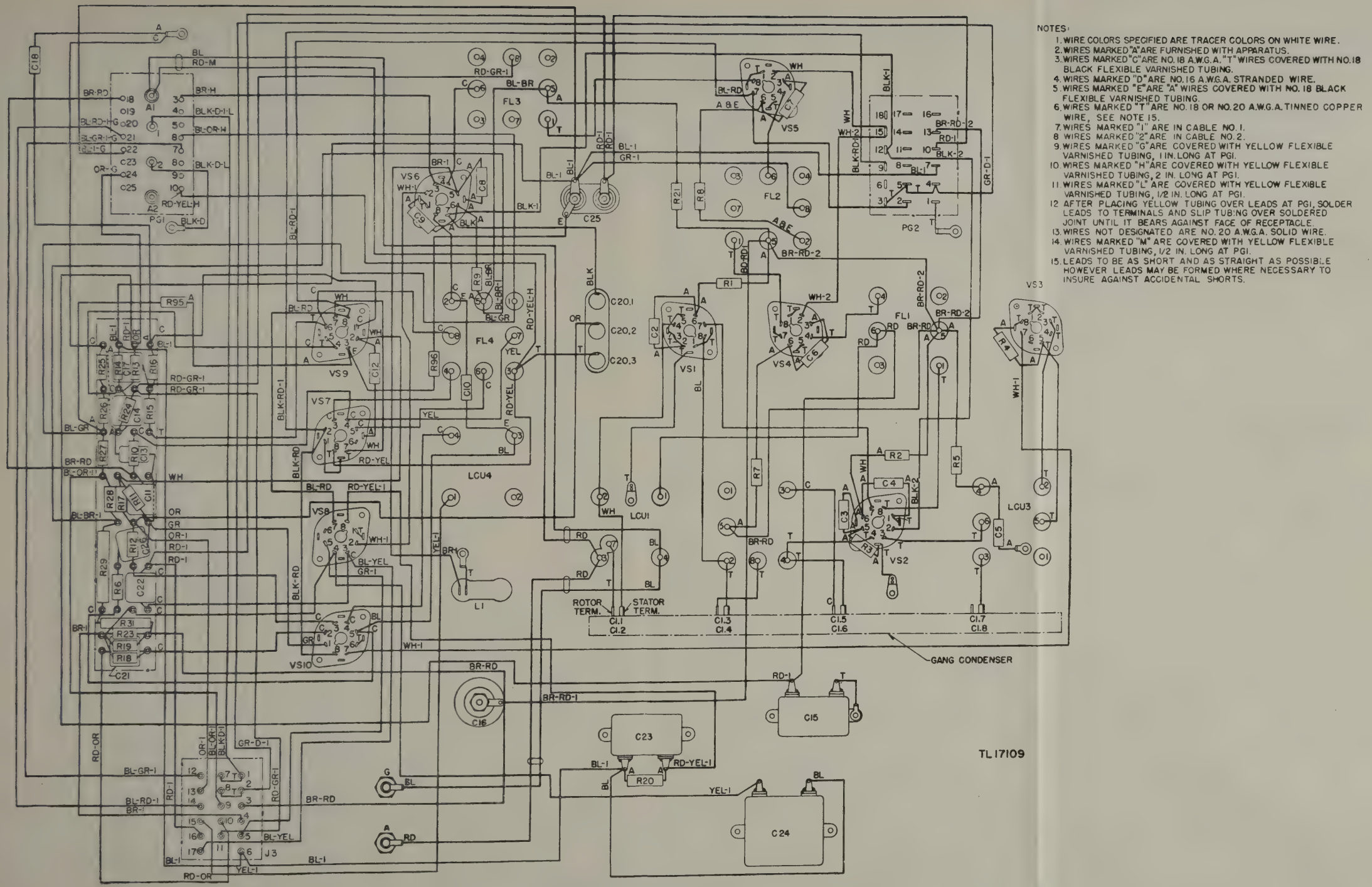

NOTES:
1. WIRE COLORS SPECIFIED ARE TRACER COLORS ON WHITE WIRE.
2. WIRES MARKED "A" ARE FURNISHED WITH APPARATUS.
3. WIRES MARKED "C" ARE NO. 18 A.W.G.A. "T" WIRES COVERED WITH NO. 18 BLACK FLEXIBLE VARNISHED TUBING.
4. WIRES MARKED "D" ARE NO. 16 A.W.G.A. STRANDED WIRE.
5. WIRES MARKED "E" ARE "A" WIRES COVERED WITH NO. 18 BLACK FLEXIBLE VARNISHED TUBING.
6. WIRES MARKED "T" ARE NO. 18 OR NO. 20 A.W.G.A. TINNED COPPER WIRE, SEE NOTE 15.
7. WIRES MARKED "1" ARE IN CABLE NO. 1.
8. WIRES MARKED "2" ARE IN CABLE NO. 2.
9. WIRES MARKED "G" ARE COVERED WITH YELLOW FLEXIBLE VARNISHED TUBING, 1 IN. LONG AT PG1.
10. WIRES MARKED "H" ARE COVERED WITH YELLOW FLEXIBLE VARNISHED TUBING, 2 IN. LONG AT PG1.
11. WIRES MARKED "L" ARE COVERED WITH YELLOW FLEXIBLE VARNISHED TUBING, 1/2 IN. LONG AT PG1.
12. AFTER PLACING YELLOW TUBING OVER LEADS AT PG1, SOLDER LEADS TO TERMINALS AND SLIP TUBING OVER SOLDERED JOINT UNTIL IT BEARS AGAINST FACE OF RECEPTACLE.
13. WIRES NOT DESIGNATED ARE NO. 20 A.W.G.A. SOLID WIRE.
14. WIRES MARKED "M" ARE COVERED WITH YELLOW FLEXIBLE VARNISHED TUBING, 1/2 IN. LONG AT PG1.
15. LEADS TO BE AS SHORT AND AS STRAIGHT AS POSSIBLE HOWEVER LEADS MAY BE FORMED WHERE NECESSARY TO INSURE AGAINST ACCIDENTAL SHORTS.
ROTOR TERM.
STATOR TERM.
GANG CONDENSER
TL17109

Figure 45. Radio Receiver BC-603-(*)—wiring diagram without front panel.

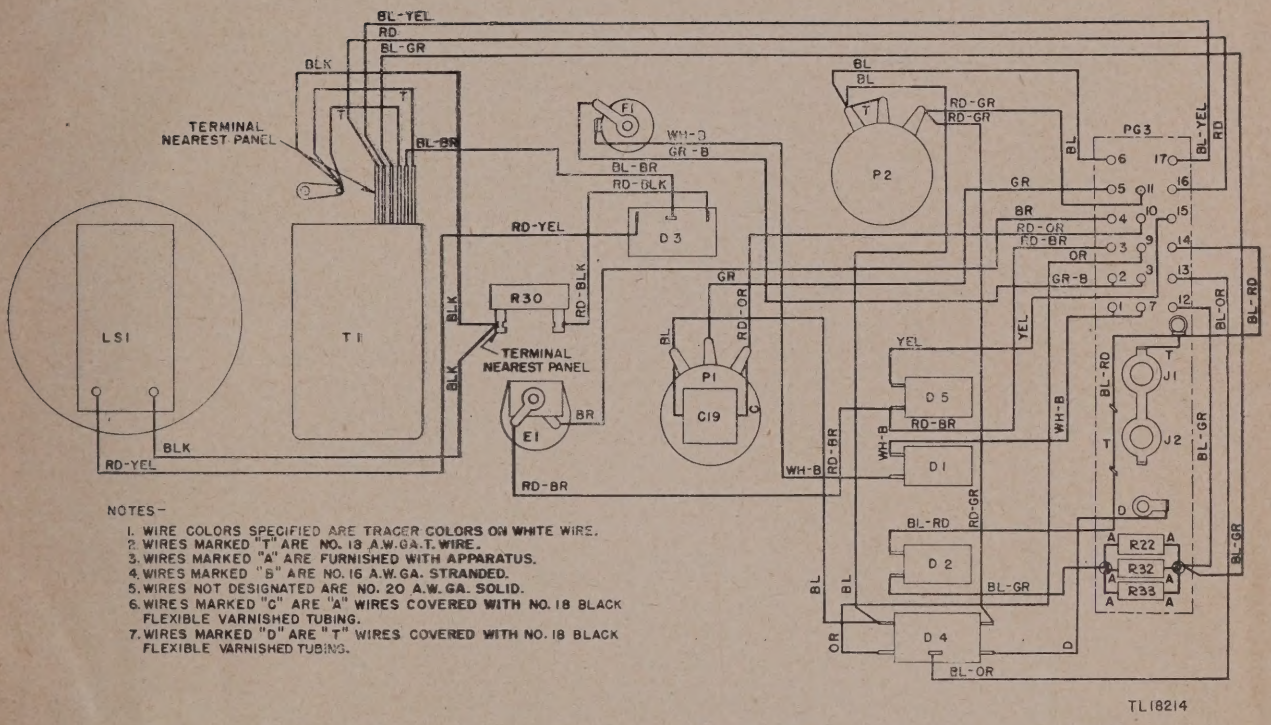


Figure 46. Radio Receiver BC-603-(*)—front panel wiring diagram.

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